DOCUMENT RESUME

ED 147 491 CE 013 373

AUTHOR Uberto, Jeffrey A.
TITLE Readings in Air Conditioning and Refrigeration.
INSTITUTION Rutgers, The State Univ., New Brunswick, N.J. Curriculum Lab.
SPONS AGENCY New Jersey State Dept. of Education, Trenton. Div. of Vocational Education.
PUB DATE Sep 77
NOTE 114p.
AVAILABLE FROM New Jersey Vocational-Technical Curriculum Laboratory, Building 4103, Kilmer Campus, Rutgers University, New Brunswick, New Jersey 08903 ($2.50 plus postage)

EDRS PRICE MF-$0.83 HC-$6.01 Plus Postage.
DESCRIPTORS *Air Conditioning; Reading Comprehension; *Reading Improvement; Reading Materials; *Reading Skills; *Refrigeration; Secondary Education; Skill Development; *Trade and Industrial Education; Vocabulary Skills; Vocational Education; Word Study Skills; Writing Skills

ABSTRACT

Designed to encourage vocational high school students to read by offering reading materials relevant to their vocational goals, this document contains thirty-seven articles related to air conditioning and refrigeration which have been selected from trade journals, magazines, and newspapers and adapted to the students' reading capabilities. A vocabulary study accompanies each article, and exercises to stimulate class discussion, improve comprehension, study, writing, word attack, and other reading skills have been provided. Since the content assumes a certain degree of technical knowledge, any unfamiliar terminology or technique within the article can be used as a basis for additional lessons. The articles cover a broad range of air conditioning and refrigeration topics, including articles on safety, new uses in the area, and other related subjects. (BM)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED147491

State of New Jersey
Department of Education
Division of Vocational Education

READINGS IN

AIR CONDITIONING AND REFRIGERATION

Jeffrey A. Uberto, Instructor

James Gleeson, Superintendent
Passaic County Vocational-Technical School
Wayne, New Jersey

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Philip L. Edgecomb

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND THE ERIC SYSTEM CONTRACTORS."

Vocational-Technical
Curriculum Laboratory
Rutgers – The State University
Building 4103 – Kilmer Campus
New Brunswick, New Jersey

September 1977

OE 013 373

NEW JERSEY DEPARTMENT OF EDUCATION

FRED G. BURKE, COMMISSIONER

RALPH H. LATAILLE, DEPUTY COMMISSIONER

DIVISION OF VOCATIONAL EDUCATION

WILLIAM WENZEL, ASSISTANT COMMISSIONER

JOHN E. RADVANY, DEPUTY ASSISTANT COMMISSIONER

HAROLD R. SELTZER, DEPUTY ASSISTANT COMMISSIONER (Acting)

JOSEPH F. KELLY, DIRECTOR,

BUREAU OF OCCUPATIONAL AND CAREER RESEARCH DEVELOPMENT

FREDERICK L. CAPPELLO, DIRECTOR,

VOCATIONAL CURRICULUM AND MEDIA DEVELOPMENT

RUTGERS – THE STATE UNIVERSITY

PHILIP L. EDGECOMB, DIRECTOR (Acting),

NEW JERSEY VOCATIONAL TECHNICAL

CURRICULUM LABORATORY

RUTGERS – THE STATE UNIVERSITY

BUILDING 4103 – KILMER CAMPUS

NEW BRUNSWICK, NEW JERSEY

TABLE OF CONTENTS

	Page
To the Teacher	i
FBI Case #2	1
Arctic Pipeline Could Be Huge Refrigeration User	4
Cars Polluting Your Air? Refrigerant May Be the Answer	8
New Coal Mining Development Makes Refrigeration Essential	11
Tennis Is "In"	15
Two Gals Prefer Hanging Ductwork Over Routine Secretarial Chores	18
Treat Them Well – They're Becoming Rare	20
Air Conditioning to Heat?	23
Refrigeration for a National Landmark	25
A Vacation From Air Conditioning and Refrigeration – Impossible!	28
Refrigeration on a Dairy Farm	32
Air Conditioning for Year Round Recreation	36
Pre-Cooled Concrete for TVA Project	39
Walk-In Coolers and Refrigerators Are Preferred	41
Experts Needed – Help!	45
Inflation . . .A Challenge to the Service Engineer	48
Freight Cars Enter Through Huge Freezer Doors	51
How To Cut Heating, Cooling Costs by Half	54
Does Air Conditioning in the Home Affect the Quality of Life There?	57
Mixing Refrigerants – A Very Real Problem	60
Auto Air Conditioning Servicing Requires a Professional	63
Air Conditioning Vs. Fuel Conservation	67
Refrigeration Keeps Him in Business	70
Old Is Still Good	73
Handling Refrigerants – How Safe Are You?	75
As You Use Your Tools and Instruments Be Aware of Electrical Safety	79
Beware of the Freak Accident	81
Death Traps	84
How Do You Ignore a Killer?	86
America Can't Function Without the Air Conditioning Industry	88
Updating With Dyed Refrigerant	91
Electronic Detection Accuracy	94
Now . . .Solar Air Conditioning	97
Keep It Cool in Court	99
Solar Energy – Fuel of the Future	101
How Does Auto Air Conditioning Affect Gas Economy?	105
Why Not?	106
References	107

TO THE TEACHER

Can we assume that English for pupils who are bound for the world of work should make a contribution to the vocational competence of those pupils? I strongly believe we can assume that.

Can we assume that pupils in vocational programs should be able to read better than they now read? Again I believe we can assume that.

The basic question, then, is how do we help our pupils improve their reading ability?

An obvious consideration is that we must get them to *want* to read. And to do this we must have reading materials that interest them – materials that are relevant to their goals.

One area of relevance is their vocational goal.

With this in mind a number of English teachers in vocational high schools have set about to develop a series of readers in vocations. This is one in that series and concentrates on readings in Air Conditioning and Refrigeration. From time to time other readers will be published which concern themselves with other trades. The result will be a reading library, at appropriate reading levels, that will deal with the trades and technologies our students are studying.

The reading selections were selected from trade journals, magazines, and newspapers. The reading levels were adapted to pupil capability. This meant re-writing in some instances.

With each article vocabulary study has been provided. There are many opportunities for learning new words, definitions, spelling. The teacher will find it easy to organize discussions, some of which can have social as well as technical impact. Exercises to improve comprehension, study, writing, word attack, and skills have been provided.

Content of these articles assumes a certain degree of technical knowledge. Any unfamiliar terminology or technique within the article can be used as a basis for additional lessons.

Articles in this book cover a broad range of air conditioning and refrigeration topics, including articles on safety, new uses for air conditioning and refrigeration and other interesting subjects.

It is hoped that this book will serve to develop an interest in reading, pride in one's chosen vocation, and skills both vocationally and academically.

Benjamin Shapiro
Director (Retired)
New Jersey Vocational Technical
Curriculum Laboratory
Bldg. 4103 – Kilmer Campus
Rutgers – The State University
New Brunswick, New Jersey

FBI CASE #2 (1)*

Vocabulary

amateur – one who does something without professional skill or ease.
The work was done so skillfully that we knew immediately that it was not done by an amateur.

consistent – sticking to a certain way of doing or saying, or thinking something.
He is consistent in his performance. It is always up to the highest standards.

expire – come to an end
You must obtain a new automobile license when your old one expires.

modus operandi – method or way of working or doing something.
Many criminals are caught because their modus operandi is the same on every job.

ponder – think carefully
The young student pondered much over his future profession.

proceed – go on after having stopped; move forward.
Please proceed with your story.

For quite some time a shadow of suspicion hung heavily over the machine room of a packing plant where heavy losses of kilowatts and temperature were being experienced. Management called the FBI (Field Borne Information) headquarters for help.

Our man Sam is told that something has to be done to arrest "High Cost" and "Temperature Loss," the two characters who are *consistently* leaving marks typical of their *modus operandi.*

In a matter of minutes, Sam is pulling his service truck up to the machine room door, where he smells a strong odor of ammonia. He pulls on a gas mask. With a 10-inch stillson wrench drawn, he enters the gloomy room and makes for the king valve on the receiver. With the help of his trusty 10-inch, he closes and tightens the packing nut behind it. Then he notices that the new six-cyclinder machine he had installed the week before is out on the oil failure switch. He pushes the reset button and watches the oil glass tc see it fill up with foam . . . a short run, and then out again on oil failure. He ponders his next move.

He moves toward the start button of an old six-by-six standby unit which he gets rolling, only to find a leak from the packing around the shaft. He stops this with a couple of jiggles on a nut or two with his trusty 10-inch again. Back to the king valve, which he opens, and the plant is back on refrigeration. Now he can turn his thoughts to what went wrong with the six-cyclinder job.

He had rebuilt and reset all the expansion valves and left the plant operating perfectly only a couple of days before. Surely someone had dented a feeler bulb on one of the valves, causing it to flood. But after a half hour of running time, no frost appeared on the suction line, only a little condensation just out of the chill room.

* Numbers in parentheses refer to Reference List, beginning on page 107.

With no liquid or saturated vapor pulling back into the compressor, Sam cannot consider this as an excuse for oil loss, so he closes the plant suction line valve, pumps out the new compressor, closes head and suction valves on it, and *proceeds* to remove the heads. The right bank is okay, with just a fine film of oil on everything, but now to the left bank. Aha – here is the culprit! There is about an inch of oil discharge all over the top of the discharge valves, which he reseals, checks out and reassembles.

He refills the crankcase, drains the oil separator, puts the "six" back in service, and cuts the old six-by-six out. He listens to her tick for a few minutes, and with a smile of satisfaction, he tucks his mask back into the case, cleans off his tools, and puts them in the truck. He goes merrily on his way, feeling he has a happy customer.

Three days later, Sam is called for a repeat performance. Everything is exactly as before, like ditto marks over a bad dream. There is the same bank of cylinders with an inch of oil over the discharge valves, and out on oil failure.

Sam carefully checks the suction screen for cuttings or carbon or any foreign matter that might have threaded its way through the screen and got lodged under a valve, but everything is completely clean.

The criminal is no *amateur.* Sam decides to have him tailed, so he puts a suction-pressure recorder on the job. Next morning the recorder registers a fairly long running cycle, which soon tapers down until running and off cycles are practically equal, but the glass on the crankcase is half empty. Here Sam decides that part of the responsibility belongs to the manufacturer, so he gets in touch with the factory field service man, who comes in, makes a few observations, then recommends reseating the valves under his supervision. Sam obeys his request, but the next morning, again there is half a glass of oil. He suggests that possibly it should be kept low in the glass, so another day – and out on oil failure switch again.

The field man decides to use up some of Sam's energy, so he recommends shipping the machine back to the factory. A couple of weeks later it is back with a new paint job and a $150 freight bill, which Sam digs out of his jeans.

Meanwhile, the plant owner decides he has purchased a lemon and sues Sam for his bill. Sam settles for labor, and reclaims the machine which the factory will not take back.

With no bridges behind, ahead is the only road. Everything is stripped off the crankcase and here is where Sam finds the criminal.

Each cylinder block was drilled and tapped directly below the suction port into the crankcase to receive a check valve. The right bank has the normally functioning check valve in it, but the left bank has never had a check valve installed, leaving the crankcase open to pull vapor all the time. When the machine cycled off the oil, it became saturated with ammonia. Since there was nothing to stop violent evaporation out of the oil on start-up, the crankcase emptied itself in about three days.

Sam marks Case Closed, Wallet Empty, Energy *Expired,* and one less customer to service.

About Words

A *prefix* is a word part attached to the beginning of a word. It changes the meaning of the word.

The prefix *re* means "back" or "again". The word *re*set means to set again.

Find 5 other words in the reading selection with the prefix *re*. List the prefix and the root word, and write the meaning.

	Prefix	Root Word	Meaning
1.	re	set	To set again
2.			
3.			
4.			
5.			
6.			

Use each of the above words in a sentence.

About the Story

For a story to have meaning, the presentation of facts in some understandable order is necessary. The presentation of information in meaningful order is called *sequence.*

Can you remember the order of the following events in the story?

Without looking back to the story, number each statement according to when it occurred in the story.

_____ Three days later Sam is called for a repeat performance.

_____ Meanwhile, the plant owner decides he has purchased a lemon.

_____ In a matter of minutes, Sam is pulling up to the machine room door.

_____ Here Sam marks, Case Closed, Wallet Empty, Energy Expired.

_____ For quite some time a shadow of suspicion had hung heavily over the machine room.

Activity

The title of this story is *FBI Case #2.* FBI is more commonly known as the initials for the Federal Bureau of Investigation. What people associate most with this organization is its war with crime and its conflict with big name gangsters. The T V series "The Untouchables" was largely responsible for creating this image.

What phrases or statements has the author included in his story to give it the effect of being a Federal Bureau of Investigation case? Does this approach add interest to a story that might have otherwise been a report of an ordinary event? Why or why not?

Write a report of an ordinary event in a style similar to that of the author.

ARCTIC PIPELINE COULD BE HUGE REFRIGERATION USER (2)

Vocabulary

capacity -- amount of room or space inside; largest amount that can be held by a container.
This can has a capacity of 4 quarts.

compress – squeeze together; make smaller by pressure.
In order to turn loose cotton into bales of cotton, it must be compressed.

concluded – ended; finished.
The book concluded happily.

ensure – make sure or certain; make sure of getting; secure.
Careful planning and hard work will ensure the success of the party.

sociological – of or having to do with human society or problems relating ot it.
The care of the poor is a sociological problem.

Now that the Arctic pipeline is becoming a reality, it is interesting to note the role that refrigeration will play in protecting the environment and moving the gas most efficiently and effectively. If recommendations of an army consultant are followed, the Arctic gas pipeline from Alaska to the Pacific northwest will require nearly 700,000 tons of refrigeration to *ensure* transmission line performance in permafrost.

R.G. Newell, of Canadian Arctic Gas Study Ltd., told the Region 2 conference of the American Society of Heating, Refrigerating, and Air Conditioning Engineers that tests costing $25 million to date indicate that refrigerated gas has hydraulic advantages in addition to being the best environmental solution.

His firm was responsible for obtaining the permits for the pipeline from Prudhoe Bay, Alaska, to the 49th parallel. Full scale tests conducted at Prudhoe, and at San Sault and Norman Wells in Canada's Yukon Territory, were *concluded* early in 1973. Other tests covering all parts of the project, from the technical to the environmental and *sociological,* are continuing.

According to present plans, the 48-inch O D steel pipeline, buried in permafrost 9 feet deep most of the way, would build over four years to a design *capacity* of 4.5 billion cubic feet per day input and 4 billion cubic feet per day output. Operating pressure would be 1,680 pounds per square inch, highest in the world.

Huge compressor stations constructed on thick gravel pads (to protect the permafrost) along the route would *compress* the gas and chill it. At each station the gas (with a suction temperature of 0° to 22° F) would first be compressed by a 30,000 hp centrifugal compressor.

The gas would be chilled to -12° by 16,000-ton gas turbine-driven centrifugal compressors using propane as a refrigerant. The system would use air condensers equipped with propeller type fans and a shell and tube evaporator. The pipeline would require about 2 million hp for compression and refrigeration.

Newell said he is hopeful that construction of the pipeline will start in the winter of 1975 and be completed by the end of 1978. Most of the permafrost construction will be done in the winter so that there will be minimum disturbance to wildlife and vegetation.

The permafrost, which varies from 200 to 2,000 feet in depth, extends quite far south into Canada. By keeping the gas below freezing, the pipeline and the permafrost will not be subject to unnatural stresses.

Even when the pipeline reaches the Canadian prairies (beyond the permafrost) some refrigeration will be used because of the hydraulic advantages of transporting chilled gases.

PERMAFROST TEST SITE

About Words

In previous lessons you learned about prefixes. *Suffixes* are word parts added to the end of a word.

When a word ends in an e and the suffix being added begins with a vowel, drop the vowel at the end of the word and add the suffix.

dare + *ed* = dar*ed*
dare + *ing* = dar*ing*

Add the suffixes *ed* and *ing* to the following:

scare
hobble
tame
live
smile

When a word ends in a consonant that is preceded by a vowel, the final consonant is doubled and the suffix added.

swim + *ing* = swim*ming*

permit + *ed* = permit*ted*

Add the suffixes *ed* and *ing* to each of the following words:

hop
slap
grab
mat

When a word ends in a y that is preceded by a consonant and you want to add a suffix beginning with an e, you change the y to i and add the suffix.

cry + *ed* = cr*ied*

Add the suffix *ed* to the following:

try
carry
cry
hurry
fancy

List the root word and suffix for each of the following:

	Root Word	**Suffix**
shutting		
settled		
tracing		
swimming		
solved		
choosing		
trading		
stated		
moving		

About the Article

1. The Arctic gas pipeline will require nearly _____ tons of refrigeration.

2. Identify the following
   a. R.G. Newell
   b. Prudhoe Bay
   c. Norman Wells

3. Huge compressors will be constructed on _____ _____ to protect the permafrost.

4. The pipeline will extend from _____ to _____

Activity

Divide the class into two groups – those concerned with the effects of the pipeline on our environment, and those who feel our need for fuel is more important.

Each member of a group will raise one question concerning a point in which he believes strongly and which his group must defend in debate.

Several questions can be used each day as a basis for class debate. Each student will be required to speak 2 minutes concerning his point. An additional 5 minutes can serve as question and answer time for an opposing viewpoint.

CARS POLLUTING YOUR AIR?
REFRIGERANT MAY BE THE ANSWER (3)

Vocabulary

accelerator – device that causes an increase in the speed of anything, the pedal that controls the flow of gasoline to an automobile engine.
The car sped forward as the driver pushed the accelerator to the floor.

auxiliary – helping; assisting
The auxiliary police help greatly in relieving the city patrolmen of the less important tasks.

comparable – able to be compared
A fire is comparable to the sun; both give light and heat.

hydrocarbon – any of a class of compounds containing only hydrogen and carbon
Gasoline is a mixture of hydrocarbons.

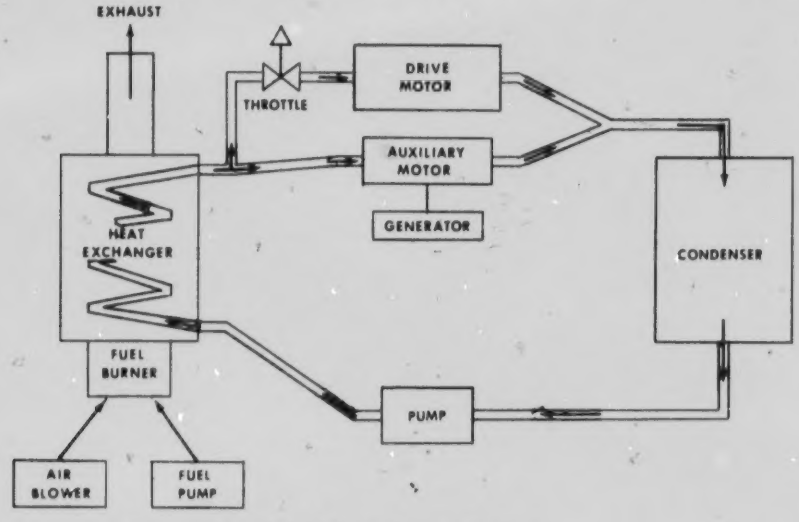
replenishment – a fresh supply
In order to continue the military action, a replenishment of weapons is necessary.

rupture – a break
The rupture of a blood vessel can cause serious bleeding.

throttle – valve regulating the flow of steam; gasoline vapor, etc., to an engine
They lessened the speed of the engine by closing the throttle.

The Minto engine is a modern day version of the steam driven motor car of the early 1900's. The "engine," which is really an entire engine system, was invented by Mr. Wallace L. Minto. It has been brought from drawing board to actual operating stage in Sarasota, Florida.

The engine basically consists of a heat exchanger, driver motor, condenser, and pump. Fuel burners fed by a pump and air blower provide heat to operate the heat exchanger. The fuel may be any *hydrocarbon* fuel such as kerosene, fuel oil, or gasoline.



The Minto Engine System

In the heat exchanger, heat from the burners is used to boil refrigerant liquid R-113. The refrigerant vapor passes from the heat exchange drive motor through a *throttle* valve. The throttle valve (operated by the *accelerator* pedal) controls the pressure and amount of vapor entering the drive motor, thus controlling the speed of the car.

Refrigerant vapor from the heat exchanger also goes to an *auxiliary* motor which runs the alternator. From those two motors the vapor passes into a condenser, where it is changed back to a liquid. The liquid is pumped into the heat exchanger to start the closed cycle all over again... burning kerosene boils the refrigerant, which in turn drives the motor and is used again. (see diagram.)

Exhaust from the Minto is truly pollution free. It is more than 200 times cleaner than will be required by 1980 H.E.W. standards. This is accomplished by burning the fuel as an open steady flame with extra air supplied to keep carbon monoxide down to breathable levels. Nitrogen oxides are not formed, since burning occurs at atmospheric pressure and combustion gas is recirculated and cooled slowly.

There are other advantages claimed by the manufacturer. This automobile in mass production will weigh about the same or slightly less than a *comparable* car today. It will be cheaper by a couple hundred dollars and will get about the same mileage on kerosene as a new 1965 (pre-pollution control) auto got on gasoline. General maintenance will require *replenishment* periodically (as do air conditioners).

The R-113 has a very low decomposition rate of about 0.02 percent per year. R-113 is a non-flammable, non-poisonous material which offers no hazard, even if the system were *ruptured* in a severe auto accident. In this respect it is similar to the fluorocarbon refrigerant now used in all air conditioned cars.

Since the drive motor has only two moving parts (plus four bearings) it would outlast its owner, if it were made of steel. It will probably be made of aluminum, or perhaps even plastic, which would result in a lower initial cost and a useful life at about 150,000 miles. It could then be replaced for less than $100 because the throttle valve and expanding vapor in the engine truly control the speed of the automobile. Closing the throttle provides dynamic braking, especially at high vehicle speed.

The physical nature of this engine system will limit its use to new automobiles. Old autos could be rebuilt, but the cost would be more than triple that of a new car.

About the Article

1. What is the Minto engine compared to?

2. List three advantages that the Minto engine has over present automobile engines.

   What are its disadvantages?

3. Using the diagram as a guideline, give a step-by-step account of how the Minto Engine System works. Include all important details such as type of refrigerant and fuel used.

About Words

Words can be spelled the same as other words but may have different meanings; as they may be spelled differently, but *sound* the same.

Exhaust may refer to a pipe or other engine part through which gases escape. What other meaning does it have?

Use your dictionary to find the different meanings for each of the following words:

exhaust
pedal, peddle
mass
respect
boil

Can you think of five other words that might be spelled the same or sound alike but have different meanings? List them.

In your notebook, write sentences using the different meanings of the above words.

Activity

1. If you were designing a car for the future, what standards would you set for safety, fuel economy, etc. Can you draw a picture of what it might look like?
2. The article refers to the 1980 HEW standards. Find out what these standards are. How close do the cars of today come to meeting these standards?

NEW COAL MINING DEVELOPMENT MAKES REFRIGERATION ESSENTIAL (4)

Vocabulary

methane -- colorless, odorless, inflammable gas. It comes from marshes, petroleum wells, volcanoes and coal mines.

occupational – having to do with one's business, employment, or trade
Kidney malfunction is an occupational disease that attacks many tractor trailer truck drivers.

perspiration – sweat
Perspiration dripped from the young girl's forehead as she struggled desperately to regain her lead in the tennis match.

refuge – shelter or protection from danger
A wildlife refuge is designed to protect endangered animals.

The U. S. Bureau of Mines puts our coal reserves at 3.2 trillion tons; the National Coal Association says perhaps only 800 billion tons of that can effectively be mined with present or near future technology. Refrigeration may play an important role in increasing this figure.

Refrigeration is playing an important role in a 5 million dollar study designed to prove the benefits of mining coal in an oxygen-free environment.

The development hopes to win acceptance for the method on the basis of *methane* gas recovery, prevention of sulfuric acid and resulting mine equipment corrosion, the elimination of fires, explosions, and elaborate precautions against them, and the elimination of black lung as an *occupational* disease.

One phase of the program tested the major parts of a life support system which included a pressure tight helmet and suit, an oxygen supply, a carbon-dioxide absorber, and a chiller module capable of delivering ventilation air to the suit.

Two miners were trained to operate five conventional coal-mining machines while using the life-support system in a real mine. They also performed other functions involved with mining coal.

The miner carries the portable oxygen module with him to the equipment he operates. It does not remove any body heat or *perspiration.* A 125-lb. fixed chiller module mounted on and driven by the mining equipment can remove 3,000 Btuh from the miner's suit. The recirculated air can be controlled at 72°F and 40% relative humidity.

Should the suit be torn or the face plate broken, an emergency rebreather carried by the miner allows him 45 minutes to reach a *refuge* station or to get out of the mine. A voice-actuated FM communication system is built into the helmet.

Heat generated by the mining equipment, estimated at 600,000 Btuh per section during full operation, would be removed by recirculation of the mine atmosphere using an externally ducted ventilating fan, refrigeration, and conduction to the walls of the mine.

The refrigeration system would be located outside the mine and would be connected to chilled water coils within the ductwork. Water sprays would clear the coils of dust. The demonstration mine section required 50 tons of refrigeration. The mine atmosphere would be controlled between 55° and 74°. The atmosphere circulation rate should not produce any more or less of a dust problem than conventional ventilation.

Air-ventilated refuge stations would be located near the work stations to provide regular breaks for miners and to provide a safe haven in the event of accident or emergency.

In gassy mine operations, the circulating oxygen-free atmosphere would be natural gas from the coal formation. Discharge gas would be pressurized by a blower and moved into a natural gas pipeline. Methane gas recovery of up to 15 million cubic feet per day could amount to 20% of total mine revenue.

In mines where gas is not a problem, the noncombustible oxygen-free inert gas is a mixture of carbon dioxide, nitrogen, and water vapor produced when natural gas and air are burned in a standard industrial inert gas generator. This generator also would provide the gas required for the gas locks and the interface between the mine and the outdoors. The conveyor emerging from the mine will pass through a water seal, which will prevent gas from escaping and air from entering.

Further experimentation and evaluation of the experiences described above will continue. However, wherever these things take us, it is obvious that refrigeration will play an important role in safer and more profitable deep coal mine operations.

About the Article

1. The U. S. has coal reserves of about
   a. 2.5 trillion tons
   b. 800 billion tons
   c. 4.2 trillion tons
   d. 3.2 trillion tons
2. What does the development of the system outlined in the article hope to achieve?
3. What is included in the life support system?
4. How effectively can a man function within the life support system?
5. What other safety precautions are being taken?
6. Does the new system have any economic value? If so, what?

About Words

To pronounce correctly a printed word you read for the first time, you may have to divide the word into syllables. These rules will help you.

1. When only one consonant letter comes between two vowel letters, the consonant letter usually begins the second syllable.

   pre sent

2. When two consonant letters come together in a word, the first syllable usually ends with the first of the two consonants.

   per haps

3. Two letters that are pronounced as a single sound, such as *th, ch,* or *sh,* are not separated when a word is divided into syllables.

   meth od or *me thod*

4. If a prefix has been added to a root word, the prefix often forms a separate syllable.

   re set

5. If suffix ed follows *t* or *d* the *ed* forms a separate syllable.

   mount ed

6. If a consonant letter comes before *le* at the end of a word, the last syllable is *le* plus the consonant letter before it.

   com bus ti ble

Divide the following words from the article into syllables. Next to each word include the number of the rule or rules used in dividing the word.

a. methane
b. effectively
c. billion
d. technology
e. playing
f. important
g. feasibility
h. against
i. capable
j. rebreather
k. operated

Activity

Find out in what ways coal is being used today as a source of energy.

If there is so much coal in the U.S., why don't we use more of it? Is it non-polluting and practical?

TENNIS IS "IN"
AND AIR CONDITIONING HELPED (5)

Vocabulary

discharge – give off; let out
The wound discharges pus.

infrared – the invisible part of the spectrum whose rays have wave lengths longer than those of the red part of the visible spectrum.
Most of the heat from sunlight, incandescent lamps, carbon arcs, and resistance wires is from infrared rays.

protrude – stick out
A handkerchief protruded from his pocket.

velocity – speed; rate of motion
The velocity of light is about 186,000 miles per second.

(1) The Mill Creek Racquet Club is a prime example of the rapid growth of tennis recreational complexes. Indoor tennis courts are becoming more popular, more complex, and are expanding rapidly.

(2) One of the largest indoor tennis courts is the Mill Creek Racquet Club. The club opened recently, with ten courts and two arenas, covering 67,000 square feet. The court area measures 250 feet long and 244 feet wide. A regulation football field by comparison is 360 feet long and 160 feet wide.

(3) At its outset, Mill Creek was by far one of the largest facilities of its type in the nation. It is now being expanded to include a new clubhouse and seven more tennis courts.

(4) The air conditioning air supply is designed to *discharge* under any *infrared* heater or the high intensity lights which are used to illuminate the courts. Design temperatures were 75 degrees in the summer and 65 degrees in the winter.
The equipment selected for the first 10 courts were 10 climatrol ground level, single package air conditioning systems. The "pitch" of the roof and building construction prohibited the use of roof mounted equipment.

(5) The units, each with 10 nominal tons of cooling capacity, were mounted outside the buildings. Five of 10 units rest on supports over a concrete drainage ditch. The other five (for the second building) rest on concrete slabs.

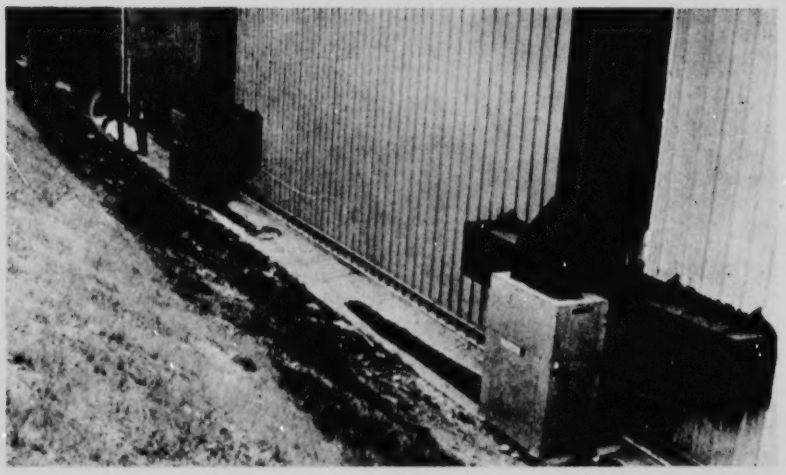
(6) The air distribution system consists of two horizontal cold air returns and a single supply duct. All ductwork is located outside the building with the exception of the supply duct stub, which *protrudes* four feet into the tennis court area – 20 feet above the floor. All supply and return duct work is interior lined with one-inch-thick fiberglass insulation. The supply duct is also fitted with a single four-way throw pattern grille.

(7) Each of the 10 systems is controlled by an individual thermostat located near one of the cold air returns. A remote on-off switch panel with indicator lights is located in the registration area to energize or de-energize each of the 10 systems. During mild weather this assures air conditioning only when individual courts are being used.

(8) Low velocity air discharge, individual cooling system control for the separate courts and low *velocity* return (so that it does not affect the back court drop curtains) were important design considerations for quiet system operation.

(9.) The equipment also had to have the capability of being serviced from the outside to avoid disruption of court use.

(10.) At ten dollars per hour, you can expect comfort at Mill Creek.



About the Article

1. Which of the following statements is incorrect?
   a. Tennis is growing more and more popular.
   b. The Mill Creek Racquet Club is being expanded.
   c. The courts are illuminated with flourescent lights.
   d. The Racquet Club does not use roof mounted air conditioning equipment.
2. Give an accurate description of the air conditioning system used at Mill Creek. Include the reasons and advantages for such a designed system.

Activity

Air conditioning and climate control have been largely responsible for the growth of indoor tennis, since they provide comfortable temperatures throughout the year. Has air conditioning affected the growth and popularity of other sports? If so, how?

About Words

Antonyms are words that have opposite meanings.

Select a word from the paragraph that has a meaning most nearly the opposite of the words below. The numbers in parentheses refer to the corresponding paragraph numbers.

contracting	(1)
contrast	(2)
darken	(4)
several	(7)
increase	(9)

The article indicates that tennis is "in". What does it mean when it is said something is "in"?

Confusing Words

accept – except

Accept is a verb; it means "to receive"

Except may either be a verb or a preposition. As a verb it means "to leave out" or "to omit." As a preposition it means "with the exclusion or exception of."

Use the correct word (accept or except) in each sentence.

1. Everyone was invited _____ Jim.
2. She will be there tonight to _____ her award.
3. I have done all my work _____ for English.
4. Will you _____ my apology?

Construct four sentences of your own using the word accept. Construct four using except.

TWO GALS PREFER HANGING DUCTWORK OVER SECRETARIAL CHORES (6)

Vocabulary

agility – ability to move quickly and easily

The big man's great agility was the reason for his outstanding success as a basketball player.

enthusiastic – eagerly interested

He was enthusiastic about the possibility of playing in the championship game.

potential – possible as opposed to actual

The potential for getting a good job is greater for the hard working student.

precarious – not safe or secure

She was in a precarious position on the edge of a cliff.

venture – a risky or daring undertaking.

His last business venture was unsuccessful.

Triangle Cooling & Heating Co. is *enthusiastic* over the successful *venture* of hiring women to hang ductwork and install thermostats.

The local contractor hired Pat Hoover and Jackie VanScoyoc, and both gals report they much prefer working on the jobsite over the routine of office secretarial work.

Pat splits her working time between handling office chores and working in the field. "It's a great help to us that she understands what actually working at a jobsite is like for the work she does in the office." says Ray Sunter.

Jackie said she tried many types of work before getting into the air conditioning business. "I like this better than anything – I can be myself."

Neither Pat nor Jackie say they have any difficulty with adjustment problems in working in a formerly all-male vocation. In fact, both noted that if anything, their male counterparts have "cleaned up their language" a bit since they've been working in the field. "It's a lot better than that used by women in many offices," Pat added.

One *potential* problem of hiring women in this field is their possible limited strength in lifting heavy objects, says Sunter. But Pat and Jackie's jobs do not call for this type of lifting because they install lightweight fiber ductwork.

In fact, he added, their size and *agility* can be an advantage. Both girls climb about in building rafters after maneuvering themselves from sometimes *precarious* ladders.

Sunter says that the experiment with the girls has been so successful that he will gladly hire more women as he finds suitable candidates. He added that some other air conditioning contractors are now starting to search for women to fill this type of position.

About Words

Contractions are two words joined together in a shortened form to make one word.

It *is* = It*'s*	Have *not* = have*n't*
It *has* = It*'s*	They *had* = They *'d*
They *have* = they*'ve*	They *would* = They*'d*
We *will* = we*'ll*	They *are* = They*'re*

Look at each contraction below and decide what two words make up each contraction.

don't	they've
he's	couldn't
I'd	they'll
mustn't	aren't
I've	he'll
we've	we're

Quotation marks " " are used to show the exact words used by someone in speaking or writing.

Can you find 4 instances in this article when quotation marks were used for this purpose?

Show the quotes and indicate who is being quoted.

About the Article

1. What were some arguments for and against having women work on the job?

2. How did the girls feel about their new positions? Did they foresee any problems?

Activity

With women moving more and more into occupations formerly occupied only by men, what is your reaction?

Select a particular occupation and present your arguments for or against women entering the field. How about men entering an occupation considered "women's work"?

Suggestion: This can be done first as a written exercise and later used as a basis for classroom discussion and debate.

TREAT THEM WELL – THEY'RE BECOMING RARE (7)

Vocabulary

ambitious – desiring strongly; eager
John is ambitious. He wants to get through high school with the top grades in his class.

asset – something having value
Ability to get along with people is an asset in business.

charisma – a quality of an individual that attracts others to him.
Great actors have a lot of charisma.

chronic – constant; habitual
Larry is such a chronic liar that no one believes him anymore.

plausible – appearing true, reasonable or fair
"I got a flat tire" and "my car got stuck" are some plausible excuses students use for being late to school.

Did you ever wonder what kind of people employers are looking to hire? Do you have the qualities they are looking for?

The following article gives one man's opinion on the qualities he feels should be present in the man or woman he hires.

How would you match up? Read and find out.

What kind of people do you want working for you? If your answer includes highly intelligent, aggressive, *ambitious* . . . be careful. These qualities may hide the fact that an employee lacks some other characteristics which are becoming extremely rare.

An over-emphasis during the last ten or fifteen years on being the personable, communicative, charming personality has left a void in training which is a *chronic* lower back pain to today's businessman. But still these charmers tend to overshadow the genuine usefulness of less "pushy" employees to the extent of more pay and faster promotions.

May we suggest you take a close look at the man or woman with average or slightly above average intelligence who feels a responsibility to develop every *asset*. These are the people who don't rely on creative ability to manufacture *plausible* excuses or to put the blame for failure on somebody else. You can count on them to be there doing the job when they are supposed to be there.

Because they are not sure they know it all or can bluff their way through any situation, these people take the time to study and learn. They will devote extra time to such things as refrigeration service extension classes and keeping current on the latest t echnology of the profession.

These people may take a little longer to find a solution to a work problem, but they'll find it. They don't jump to conclusions, and when they have done a job, it's usually done right without wasting time.

You find these quiet professionals easy to work with, understanding toward others, and even willing to listen. They are that way because things came a little harder for them. They've been down that learning road, and they're a little more tolerant of other people's faults.

Be careful you don't overlook them, because they're not the type to be continually doing and saying things just to attract attention or to impress the "boss." On the other hand, you may have already discovered that when you've got a job you want done, and done right, they're the ones you turn to. They take pride in their work and in the company – as well as themselves.

So next time you're looking for a new employee to hire or the next time you're considering who in your company deserves the big break, take a look at the person with a sense of responsibility, the person with perseverence. *Charisma* is a very splashy asset, but sometimes it wears a little thin.

About the Article

1. What does the author see as characteristics that have been too highly emphasized in hiring someone for a job?

2. What does he see as possible results from hiring people with these characteristics?

3. Which person do you think this author would hire?
   a. genius
   b. charmer
   c. a person with average intelligence
   d. a person with charisma

Give reasons for your choice.

About Words

Suffixes are additions made at the end of a word. They may change the meaning of the base word and also may change the way it is used in a sentence.

The suffixes *ist, er, or, ant, ent* and *ee* frequently mean a person who is concerned in some way with the idea in the base word.

humor + *ist* = humorist: a person who writes or tells jokes or funny stories.

Find words in the article with *er, ant, ent* and *ee* suffixes. List the base word, the word with the suffix added, and its meaning.

Use these words in a sentence.

Other suffixes in the selection are *ence, ance, ty, ity, ly, able, ful, ive,* and *ious.*

Find these suffixes in the article. List the base word, the word with the suffix added, and the meaning.

Discuss how the addition of these suffixes affects the meaning of the base words.

Activity

Do any of the characteristics in the story apply to you? Explain.

Give a character description of the person you would most likely want to work with or for you.

AIR CONDITIONING TO HEAT? (8)

Vocabulary

complexity – quality of being complicated
The complexity of the road map puzzled him.

contemporary – belonging to or living in the same period of time; of the same age or date
Water and air pollution are contemporary problems that must be faced and solved.

conventional – customary
"Good morning" is a conventional greeting.

expended – used up
Because of an undetectable leak, precious gas was expended into the atmosphere.

innovative – of or pertaining to new ideas or methods
The innovative approach to production increased output by almost 15%.

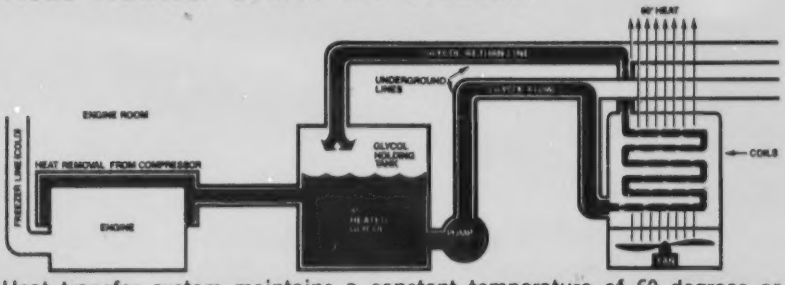
How can refrigeration be used for heating? Read to find out.

The *complexities* of *contemporary* problems often defy ordinarily logical solutions. Southern Michigan Cold Storage's newly operating heat transfer system provides a clear example of how *innovative* thinking and procedure can resolve matters.

A 26,000 square foot plant addition for unrefrigerated items – primarily machine parts, paper, canned goods, and similar items – demanded a constant temperature of 60 degrees or above. Called in to analyze all factors involved, the firm of Gerald A. Fisher & Co. conceived a plan which would drastically reduce costs through application of a time honored engineering principle: Cold is the absence of heat. Creating cold requires the removal of heat energy. But energy is never really lost; instead it is transformed or transferred.

Projected heating costs by *conventional* means ranged from $4,700 to $6,200 annually, depending upon choice of fuels – propane gas or oil (both in short supply and natural gas unavailable). The energy conserving proposal was to transfer the heat extracted from refrigerated areas of the structure – maintained at 10 degrees below zero – to where it was needed rather than to where it was merely wasted, *expended* into the atmosphere. Operating costs would run approximately $700 per year.

Heat Transfer Solves the Problem



Heat transfer system maintains a constant temperature of 60 degrees or above for the Southern Michigan Cold Storage facility. Heat removed from refrigerated areas is carried by a propylene glycol solution to heating coils located in the new warehouse.

23

The operation is as simple as the logic behind it. Heat removed from refrigerated areas is carried by a propylene glycol solution to heating coils located in the new warehouse. Beyond this the system is similar to hot water heating.

By maintaining a more or less self-contained, balanced heating-cooling operation, the equivalent of 31,400 gallons of fuel will be saved, in the first year of operation. And savings are expected to increase to 47,800 gallons when a new addition under construction is completed.

Cost of installation and equipment is $16,000. This figure does not include the existing compressor and related equipment used in the cooling process. To install this system in a plant that does not have excess heat to discharge would be considerably more costly, since heat would have to come from a boiler or similar heat plant.

According to the president of Southern Michigan Cold Storage, the system has proved a complete success and has operated efficiently during near zero weather.

About the Article

1. What is the definition of cold?
2. What is the energy saving proposal in this article?
3. Why would it be more costly to install a system of this type in a plant that has little or no excess heat?

Activity

Looking at the diagram on page 23, give a step by step account of how this system would work.

Be sure to include all important details.

About Words

A *prefix* added to the beginning of a word may change its meaning.

The prefix *trans* means *across* – *trans*port

The prefix *dis* means *away* – *dis*connect

What words in the article contain these prefixes? List them and write what each word means. Use these words in sentences.

Think of and list 5 other words containing the prefixes *trans* and *dis*.

Make up sentences using these words.

REFRIGERATION FOR A NATIONAL LANDMARK (9)

Vocabulary

arcade – any covered passageway; passageway with an arched roof
The arcade around St. Marks Square in Venice is one of the most beautiful in the world.

designated – named; entitled
The ruler of the country designated his son Prime Minister.

device – a mechanical invention used for a specific purpose.
He perfected a device to improve his tennis game.

promenade – a public place to walk for pleasure or display
The third floor promenade walls were lined with copies of the world's most famous paintings.

sash – frame for the glass of a window or door
The sashes on the old house had to be replaced.

A forerunner of enclosed shopping centers, the *Arcade* in Cleveland, Ohio, is a *designated* national landmark. Built in 1890, the Arcade was for many years the largest glass-roofed structure in the Midwest with its 60-by-290 foot long skylight.

Beneath the skylight, five galleries with impressive ironwork railings surround the main floor *promenade*. The galleries connect two 10-story towers which face main streets in downtown Cleveland. Today, the first two galleries contain 50 commercial stores. Over 100 office suites are housed on the remaining three levels.

For the past five years, Noeth Air Conditioning Corporation has provided air conditioning and year-round climate control systems for many of the Arcade's offices and stores. Recently, the Noeth company installed a Climatrol 753 single package electric heating and cooling unit in the offices of Alan M. Voorhees and Associates, Inc., an international engineering firm specializing in transportation systems and urban centers. When the Arcade was built in 1890, it featured the best in climate control – steam heat. Upgrading the heating and cooling system was part of the remodeling project for the Voorhees company suite. Steam radiators and window air conditioners were replaced by Climatrol equipment.

The Climatrol 753 is a through-the-wall unit but is equally effective when placed flush with a window. The lower *sash* from one window was removed and a gasket was installed around the 753. An angle iron stand was fabricated by Noeth to support the 753. Cork-to-rubber-to-cork vibration eliminators and a canvas duct connector are two of the sound control *devices* used. The Climatrol 753 has a 5 kilowatt heating element and a 2½ nominal ton cooling capacity. The electrical power for both heating and cooling can be easily met with existing wiring.

About the Article

Finding details

1. When was the Arcade first built?
2. How large is its skylight?
3. How many galleries are in the Arcade?
4. What does each gallery contain?
5. What climate control did the Arcade feature when it was first built?
6. Can current electrical wiring meet power for both heating and cooling?

About Words

More about suffixes:

The suffixes *er* and *est* can be added to a word as a means of comparison.

large – larger – largest
Jimmy is large.
Bill is larger than Jimmy.
Tom is the largest of all the boys.

Add the suffixes *er* and *est* to the following words and use them in sentences that make comparisons.

short
low
strange
high
small
cool
tall

When adding these suffixes to words that end in y, you drop the y and add i.

heavy – heavier – heaviest

Add the suffixes *er* and *est* to the following words and use them in sentences that make comparisons.

happy
funny
windy
shiny
angry

What form of the word in parentheses would you use in each sentence?

Tom was _____ than his sister. (angry)

John is the _____ runner on the track team. (fast)

But he is not _____ than some boys in his gym class. (fast)

When he grows up, he wants to be _____ than his father. (tall)

Today was the _____ day of the year. (warm)

Some days last year were _____ (warm)

That metal is _____ than gold. (shiny)

My folks were _____ to see me than my brother. (happy)

I want to get a _____ score on the test this time. (high)

He is not the _____ comedian I've ever seen. (funny)

Activity

Compare the Cleveland Arcade to today's large enclosed shopping malls. Were you surprised to learn that such a structure was built back in 1890?

A VACATION FROM AIR CONDITIONING AND REFRIGERATION – IMPOSSIBLE! (10)

Vocabulary

anticipate – look forward to; expect
He had anticipated a good vacation in the mountains; but when the time came he became ill.

inconspicuous – attracting little or no attention
His presence was so inconspicuous that no one noticed when he left.

itinerary – route of travel; plan of travel
The trip's itinerary indicated that we would visit Florence before Rome.

minute – very small
A good detective will consider every minute detail in solving his case.

precise – exact; definite
The precise sum was 72 cents.

routine – a fixed regular method of doing things
Getting up and going to bed are parts of your daily routine.

surveillance – watching over someone or something
The police used surveillance equipment to keep a closer watch on the suspected criminal.

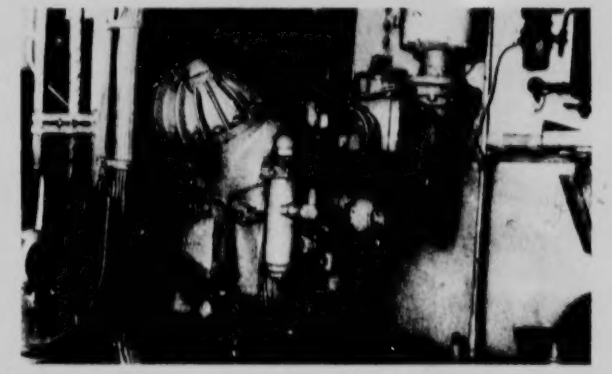
trilingual – knowing three languages
His trilingual background made this trip through Europe an easier one.

Ordinarily a voyage on a passenger-carrying freighter would seem to be instant escape from the world of refrigeration and reality. Travel literature mentions only the relaxed atmosphere, complete informality, modern staterooms, and high adventure at the fascinating ports on the ship's *itinerary*. In addition, there is promise of elegant dining and tax free lounges.

This is the mental picture which prompted my decision to go to Europe via freighter for a first-hand look at European refrigeration and air conditioning methods. During the voyage, however, I fully expected a complete industry blackout. The voyage lived up to the travel literature promises, but surprisingly there was no industry blackout.

All this occurred on the Yugoslav freighter Alka, which makes the round trip from Rijeka, Yugoslavia, to Chicago, Illinois four times a year, during the warm weather months. As an added bonus, the *trilingual* crew offered the promise of a living language laboratory. This was an opportunity to learn or brush up on a foreign language.

The ordinary impression of a freighter's cargo-carrying activities is *routine* loading and unloading of heavy machinery, raw materials, and finished goods. This is somewhat of an over-simplification. In addition, the modern freighter is a floating refrigerated warehouse, capable of maintaining precise temperatures under highly variable conditions. This is made possible by compact, well designed systems equipped with the most modern surveillance devices.



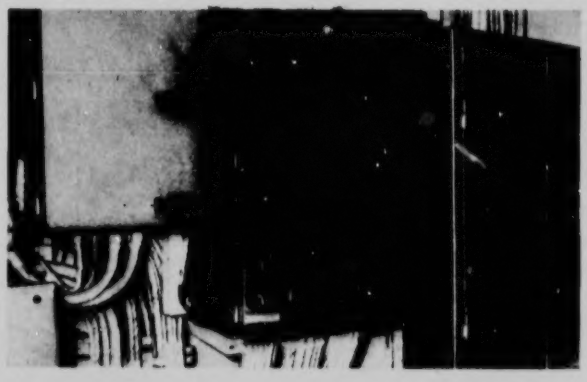
A complete tour of the Alka revealed a refrigeration equipment room with five R-12 compressors and a total capacity of over 100 tons. The compressors were equipped with every modern protective device. The total operation was instrumented in giant panels for quick visual checks of each operational phase.

Three compressors were used exclusively for ship's cargo, another was used by ship's stores and one was for the ship's air conditioning system. Typical refrigerated cargo consists of meat, cheese, and fish for the Canadian and American markets, and on the return voyage, frozen meats and by-products for the European markets. All this can be stored in five holds, with a total capacity of 340 tons. Each hold is capable of maintaining exact temperatures in a range from -5° to 55° Fahrenheit.

The temperature sensing controls which cycle liquid line solenoids are Honeywell 904E proportional motors. The end switches on the motor are used to cycle the cylinder unloading system on the compressors. In this manner a compressor is unloaded in 25% increments until it cycles off. Then the next compressor unloads in the same manner. Thus refrigeration capacity is varied from full-on to a complete shutdown, depending on load requirements.

Service problems were an interesting item of conversation. Strangely enough, only two men on the ship's crew have ever had training. Moreover, this training was only one phase of a six-year course which involved the ship's total mechanical system. This meant that their refrigeration knowledge had to be of a general nature. One wonders how this type of service personnel could handle any problem of a complex nature.

One answer was the completely instrumented control panel which registers pressures, temperature, and fluid movement in all key locations. This, coupled with a tell-tale light warning system, serves to localize any problem immediately. Another answer is an *inconspicuous* looking, green ship's refrigeration manual.



This is the tell-tale light warning system.

The manual is a total visual and verbal explanation of every *minute* detail in the ship's refrigeration system. By means of a ready reference index system, each component is quickly identified.

In addition, every service problem has been *anticipated* and a possible solution suggested. The analysis of function, operation, and service procedures for each component far exceeded the manufacturer's description. With this type of *surveillance* and backup information, it is possible to keep small problems from becoming big ones. A lesson to be learned is that well organized service information is the ounce of prevention which pays a handsome dividend.

Only one service problem occurred on the Alka during the course of its voyage, and this did not involve the refrigerated cargo. When air conditioning was needed, the system could not handle the load. Inspection revealed badly frosted suction lines, and this was a clue to the solution. An invasion of insects over the Great Lakes had completely clogged the intake air filters. As a consultant without pay, I suggested the proper solution and was rewarded with a comfortable stateroom for the remainder of the voyage.

As travel literature says, complete rest and relaxation are possible on a passenger-carrying freighter. However, if you are trying to escape the refrigeration industry, forget it.

About the Article

1. What did the author expect on his voyage?
2. How was the ship equipped to handle the cargo?
3. Describe the routine of working on a cargo ship.
4. How prepared was the ship and its crew to handle service problems? Explain.
5. What problem did the author solve for the cargo freighter? How was he rewarded?

About Words

Some prefixes added to the beginning of a word represent a number.

uni or *mono* = one

*mono*logue – a long speech by *one* person.
*uni*cycle – a vehicle consisting of a frame mounted on *one* wheel.

di or *bi* = two, twice

dioxide – oxide having two atoms of oxygen per molecule.
bicentenial – *two* hundred years.

tri = three

trilingual – using *three* languages

List the prefix and meanings of the following

tripod
bicycle
monolith
monocle
bilateral
triplane
bisect
triple
mononsyllable
trisyllable
bilingual
trisect
monochord
unicorn

Activity

Do you know what a "busman's holiday" is?
How does it apply in this case?

REFRIGERATION ON A DAIRY FARM (11)

Vocabulary

agitation – a violent moving or shaking
Periodic agitation is necessary to keep the solution well mixed.

internal – inner; on the inside
Internal injuries are more serious because they are more difficult to locate.

ironical – contrary to what would naturally be expected
Ironically, the man was run over by his own car.

insemination – act of making pregnant
Herds are upgraded by the use of artificial insemination.

semen – fluid containing the male reproductive cells
Semen from the prize bull was inserted into the heifer.

solitude – being alone
Both the prospector in the desert and the shy person in the city live in solitude.

Most of us dream now and then about chucking the pressure-cooker life of business and moving out into the country.

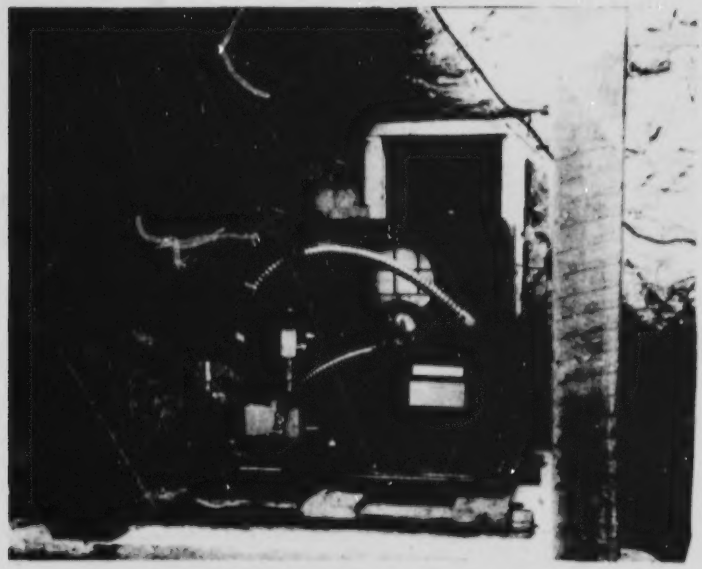
Here's a man who never had to make that decision. E. Robert Nolt still sleeps in the same bedroom he was born in over 55 years ago, in a two-story, limestone-rock house built in 1809. Here in West Hempfield Township, just outside of Lancaster, a city person can lose himself quickly in the quiet and *solitude* of 100 acres of farmland.

But while this might be a dreamland to most of us, it's a business to the Nolts – a dairy business. And *ironically,* to be a success in the country he has to rely on big-city business to make the right kinds of equipment, because refrigeration is most necessary when it comes to dairy farming.

In fact, Nolt just installed his first Jamesway "Sani Kool" milk cooler, which uses a Franklin Electric motor, 1/20 hp, to agitate the milk in the cooler. It's an oilless gear reduction unit, used to stir the milk at least once an hour so the milk doesn't freeze on the bottom of the tank, and also so the cream doesn't rise to the top of the milk.

NOLT's NEW MILK cooler eliminated the old milk cans. Milk is poured directly into this stainless steel tank now. And it's automatically stirred at at least once an hour to prevent freezing or cream separation.

BEFORE HE INSTALLED his new cooler/agitator, Nolt relied on the familiar milk can. Each can of milk was placed in this cooler. And every day a tank truck came to pick them up.



TECUMSEH COMPRESSOR

A Tecumseh Model CL312Ht compressor-condensing unit can maintain the milk below 40°F, at 90°F. ambient temperature. The compressor is equipped with an *internal* overload protector.

Periodic *agitation* of the milk, combined with steady refrigeration, allows you to dip a glass into the tank and drink fresh, cool, clean milk.

The tank itself holds over 3,700 lbs. of milk. Every two days, a tank truck from the Mount Joy Farmers Cooperative Association, a group of 132 producers, picks up the milk. Mount Joy then sells the milk to Lehigh Valley Cooperative Association, which bottles it.

In addition to processing the milk itself, refrigeration also plays a role in creating the cow that makes the milk in the first place.

Nolt keeps about 50 cows on his farm at any one time. Each cow has to have a calf before it can produce milk. A cow only produces milk about nine months after it has a calf. So, each cow must continue to have calves as long as possible.

Consequently, artifical *insemination* is a major factor in dairy farming. Nolt contracts with Atlantic Breeders Cooperative to artifically inseminate each cow as it comes into heat, about once a year. Each cow can then produce milk for 10 to 12 years.

However, in the artificial insemination process, the *semen* must be refrigerated before it is brought to the farm. Liquid nitrogen is used to freeze the semen to a solid -300°F.

To inseminate a cow artifically, only 1cc of diluted semen is required. When the representatives of Atlantic Breeders arrives at the Nolt farm, he has a can of frozen semen right in his car trunk. He simply removes 1cc from the tank, thawing it almost immediately.

About the Article

1. What is the setting described in the article?
2. What ties are there between Mr. Nolt's farm and big city business?
3. How does refrigeration help in creating the cows that produce the milk?
4. What role does each of the following play in Mr. Nolt's business:
   a. "Soni Kool" milk cooler
   b. Mount Joy Farmers Cooperative Association
   c. Atlantic Breeders Cooperative

About Words

Words are listed in the dictionary in alphabetical order. The words in bold type are called entry words. List the following words in the order in which they would be listed in the dictionary.

life	irony
dream	reduction
limestone	freeze
person	tank
Lancaster	milk
bedroom	necessary
country	bottom
cow	need
business	agitate

For more practice, put the words in each column in the correct alphabetical order:

allergy	figure	missile	wash
allegedly	fight	mistake	water
allies	fiend	mission	waste
alkali	file	might	will
anchor	flat	mill	wish
ancestor	flute	minister	wine
angle	flee	mint	war
all	floor	mink	week
alien	fake	muscle	weak
alert	fade	music	wasp

Activity

1. It is made clear in the article that even in the most rural farmland, dependence on big-city business and modern technology is necessary. Has our society become so dependent on the conveniences provided by modern technology that we could no longer function without them? What dangers do you see in such dependence?

2. In the article the words "city person" were used in reference to someone unlike Mr. Nolt. How would you characterize a "city person"?

3. Most people that work in and around the city belong to unions or associations. Farmers belong to cooperatives. Do some research into the purpose of cooperatives and their importance in American History.

AIR CONDITIONING FOR YEAR ROUND RECREATION (12)

Vocabulary

consume – use up
A student consumes much of his time in studying.

fuselage – framework of the body of an airplane that holds passengers, cargo, etc.
The fuselage was completely destroyed in the plane crash.

install – put in position for use
My dad and I installed the new air conditioner ourselves.

maintain – keep up, carry on
If the food is not to spoil, the temperature of the refrigerator must be maintained at a low level.

(1) Racquet and Rink, Farmingdale, L. I., N. Y., a year-round, 20-hour a day, 12-month a year recreation complex for skating and tennis, utilizes two Dunham-Bush PCX-230 Helical rotary screw compressor package chillers to refrigerate their two 17,000 sq. ft. ice rinks. These units maintain temperature of the ice at constant 22° to 28° and *consume* about 20-25 percent less energy than other types of chillers.

(2) Housed in a former bomber factory, Racquet and Rink, now the practice home of the New York Islanders professional hockey team, has brought a new and vital spirit to a decaying defense complex. Where glistening *fuselages* once took shape, youngsters now glide over two regulation size hockey rinks or practice backhands on its eight tennis courts. This youthful recreation complex has become the center of year-round activity for the area.

(3) Gerald DeSimone, the owner and developer of Racquet and Rink, working with Ice Systems Inc., of Saddle Brook, N. J., was able to have a fully operating skating rink ready for the public in only six months. He states that one of the reasons he was able to move ahead so quickly in *installing* the rinks was his choice of the Icemat rink refrigeration system featuring the Dunham Bush PCX-230 rotary screw compressor package chillers. Icemat is a patented low flow temperature averaging system, manufactured in mat-like sections, four feet wide and up to 100 feet long. Unlike metal or plastic pipe systems that require considerable skilled labor to install, Icemat is easily installed by unrolling it like carpeting on the rink floor of levelled sand laid over the existing concrete floors.

(4) Once installed, the Icemat grid was connected to the rotary screw package chillers, the heart of the system, located in a central equipment room. The chillers chill the glycol/water solution circulating through the Icemats from a return temperature of 22°F to a supply temperature of 10°F. The rotary screw compressor chillers installed according to Ice Systems (designer and manufacturer of Icemat), are the only units that can meet the enormous day-to-day, 20-hour-a-day varying load conditions caused by different rink activities such as hockey, figure skating, or large groups of skaters. High quality, skatable ice, depending on the activity, must be *maintained* at a temperature of 22° to 28°F. If the quality of the ice cannot be maintained, you have lots of unhappy skaters, according to Mr. DeSimone.

(5) Plans call for replacing six of the eight tennis courts at Racquet and Rink with a third Icemat rink which will also receive its refrigeration from the two Dunham-Bush rotary screw package chillers.

About the Article

1. Which of the following statements is not true?
   a. Racquet and Rink is housed in a former bomber factory.
   b. The refrigeration unit for Racquet and Rink consumes 20-25 percent less energy than other types of chillers.
   c. Racquet and Rink is the practice home of the New York Rangers.
   d. Racquet and Rink is a year-round recreational facility.
2. How does the Icemat system operate?
3. What advantages does Icemat have over metal or plastic pipe systems?
4. Racquet and Rink is increasing its number of tennis courts. True ☐ False ☐

About Words

Write the word in the paragraph that best fits the meanings below. The numbers in parentheses refer to the corresponding paragraph numbers.

always the same (1)
full of life (2)
current (3)
large (4)
marked by change (4)

Use each word in a sentence.

Guide Words

At the top of each page in a dictionary you will find two words printed in dark type. They are called *guide words.* The guide word at the top left of the page is the same as the first entry word on that page. The guide word at the top right is the same as the last entry word on that page. Words that fall alphabetically between the guide words will be found on that page.

Look at the guide words that appear on this sample dictionary page.

flute focalize

Underline the words below that would appear on this page.

focus	fodder
fold	flux
flying	flood
foam	fluting
flutter	fob

All the words below are found on a sample dictionary page. What two words would serve as guide words, and in what order would the words appear on the page?

gimlet	gild	gimp
gimmick	giggle	giggly
giblet	giddy	gifted
gift	gilt	gigantic
gig	ginger	Gila
gin	gill	Gilbert

Activity

As a class project, it may be of interest to construct a scale model of an ice skating rink.

PRE-COOLED CONCRETE FOR TVA PROJECT (13)

Vocabulary

comply – act in agreement with a request or command
We should comply with the doctor's request.

incorporating – joining or combining
He is incorporating your suggestions in his new plan.

integral – essential; necessary to the completeness of the whole
Steel is an integral part of a modern skyscraper.

In order to *comply* with Tennessee Valley Authority specifications of 70°F maximum temperature, concrete going into the new T.V.A. Raccoon Mountain pumped storage plant near Chattanooga, Tennessee, will be cooled by a mechanical ice plant system.

The 31,000 pound package unit features an ammonia refrigeration system operating on an integral ice builder which will manufacture flake ice for use in removing heat from fresh concrete in the mixers of hauling trucks.

Each 10-yard load of fresh concrete will be pre-cooled by 1,000 pounds of ice, which will serve to lower the temperature of the mix from a high of approximately 90°F to 70°F by the time the concrete is poured.

When supplied with -13°F ammonia refrigerant and 75°F water, the cold system, *incorporating* a 12 cylinder *integral* two-stage compressor with intercooler, is capable of generating 42 tons of refrigeration. The ice making machinery itself will deliver 25 tons of flake ice per day – enough to service 50 truckloads of concrete.

About the Article

1. What specifications have to be met by the new TVA Raccoon Mountain pumped storage plant?
2. How do they propose to meet these specifications?

About Words

More about syllables

Divide the following words into syllables:

1. mechanical
2. package
3. mixer
4. integral
5. operating
6. ammonia
7. compressor
8. refrigerant
9. deliver
10. necessary

After each word, write the rule or rules you applied in dividing it.

Activity

The Tennessee Valley Authority was established during the "depression" of the 1930's as a way of helping this country get back on its feet. Since then it has been responsible for many worthwhile projects.

Do research into the history of the TVA and some of these projects.

WALK-IN COOLERS AND REFRIGERATORS ARE PREFERRED (14)

Vocabulary

depreciation – a lessening or lowering in value.
The depreciation of the car has to be considered when determining its selling price.

dismantle – pull down or take apart.
We had to dismantle the bookcase in order to move it.

franchise – a distributor or retailer who has the authorization of a manufacturer to sell that manufacturer's product.
Burger King is a franchised fast food business.

prefabricated – built beforehand; manufactured in standard sections that can be rapidly assembled.
Because prefabricated homes are less expensive than conventional ones, more and more people are buying them.

premises – house or building with its grounds
The man was caught on the premises without authorization, so he was arrested by the police.

secondary – not main; having less importance
His primary reason for quitting his new job was the working conditions. His secondary reason was his inability to get along with the other employees.

stabilize – make firm, prevent changes
The President's new economic policy is an attempt to stabilize prices.

(1) Spectacular growth has been reported by the industry which produces walk-in coolers and freezers.
(2) Manufacturers of these *prefabricated* sheet steel walk-ins for cold storage estimate that 750,000 units are now on location in the U.S. alone. While they're located primarily at mass feeding and food processing/distribution locations, the latest trend is toward rapid expansion among a host of fresh, new users.
(3) Why the boom in walk-in refrigeration? Obviously, the primary cause is the dramatic rise in both mass feeding and in a variety of mass feeding situations: *franchised* fast food outlets, airline feeding, entry of vending operators into industrial food service, the mushrooming of motels and meals for guests.
(4) A *secondary* factor is the need for more freezer and cooler facilities at the food processor, distributor, and retailer levels. But that's not all! A rising opportunity for industry volume is the non-food category. Pharmaceutical manufacturers and wholesalers must keep many drugs refrigerated to prolong potency. Florists require cool storage for fresh flowers. Photographic processors and TV stations need to *stabilize* film stock under temperature-controlled conditions. Industry and government can utilize the units for environmental and testing chambers.

(5) One of the newest walk-ins is basically a refrigerated room, assembled on the customer's site from standard, modular panels, each about two feet or four feet wide. Every panel is constructed to fit into a specific section of the assembled units, floor, sides, or ceiling. (Doors with automatic closers are mounted in their own panels.) The room itself can be built to almost any width and length – including multi-compartment units when both a cooler and freezer are wanted.

(6) More than 50 percent of all walk-ins are made of 22-gauge galvanized sheet steel on both exterior and interior wall surfaces (with four-inch-thick urethane insulation foamed in place between). The galvanized steel is economically practical, strength- and corrosion-resistant; and versatile, permitting interior and exterior locations and USDA approval for use in food plants.

(7) Prefabs are easily assembled. They can be *dismantled* and reassembled on a new site, expanded by adding extra panels, or converted from coolers to freezers.

There are five basic steps in setting up a walk-in:

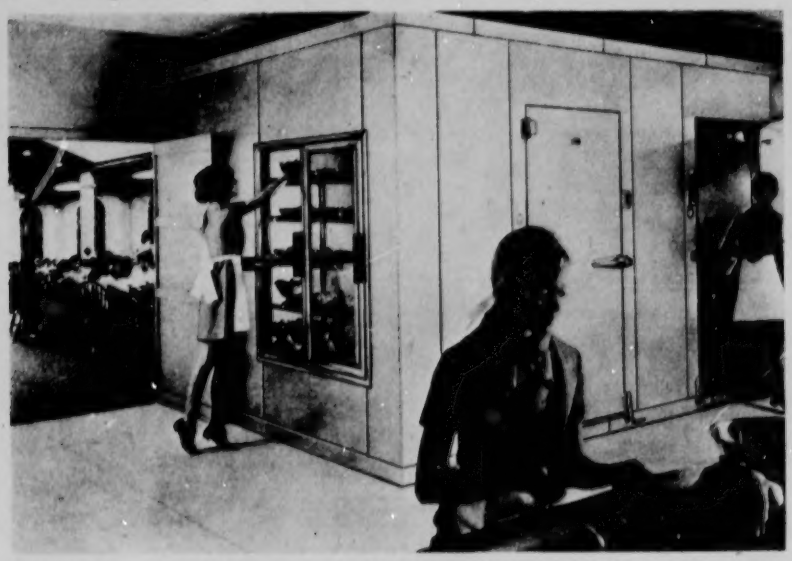
1. The floor panels are placed in position, leveled, and locked together.
2. The wall assembly is started by locking a corner and wall panel together.
3. The wall assembly is completed.
4. The top is started by locking an end ceiling panel to the side wall.
5. The top assembly is completed.

(8) The units come with complete, preassembled refrigeration systems – either a freezer system offering temperatures from 32°F down to -40°F, or a cooler's refrigeration ranging upward from 35°F. Each is mounted on a steel frame for installation on the unit's top or side wall, with the system all ready to operate as soon as electrical and drain connections are made.

(9) Of major import pricewise is the fact that today's high construction costs have made the built-in unit, custom constructed of wood or masonry on a customer's premises, about twice as expensive as the prefab described in this article. Moreover, the prefab walk-ins are accepted by the government as capital equipment and thus are subject to fast *depreciation* and investment tax credit.

(10) So popular has the concept become that now entire refrigerated buildings are constructed with this same modular approach.

(11)Whether it's a simple walk-in or full sized buildings, there is a vital growing need for large-size refrigerated storage space that is efficient, durable, flexible, and economical. The modular prefab system is an answer to this need.



Walk-ins can be totally opaque or partially glass-walled, as in this restaurant. Walk-ins have enabled kitchen staffs, or central commissaries, to cook quantities larger than currently needed and fast-freeze the excess.

About the Article

1. Why has there suddenly been such a rapid growth in the industry that produces walk-in coolers and freezers?
2. How are these prefabs constructed?
3. What are the advantages of this type of construction?
4. Pricewise, prefabs are about the same as regularly constructed freezers but are more popular because they can be installed more rapidly. True ☐ False ☐
5. Prefabs are considered capital equipment. Why is this considered an advantage?

About Words

Which word in the paragraph best fits the meanings below. The numbers in parentheses refer to the corresponding paragraph numbers.

a large number (2)
extend (4)
have need for (4)
precise, definite (5)
outside (6)
changed (7)
costly (9)

Use each of these words in a sentence.

The word element *multi* means *having many or several – many or several times.*

multiform – having many different forms

Give the meaning of the following words and use each word in a sentence.

multicellular
multilateral
multitude
multistage
multimillionaire
multiply
multi-compartment
multi-stage
multi-colored
multi-sided

More with Prefixes

Look through the article and find words that contain prefixes we've looked at before.

List these words and give their meanings.

Use these words in sentences of your own.

Activity

In recent years we have heard much about "prefabricated" or "modular"items – for example, prefabricated homes. What are the advantages and disadvantages of this concept?

EXPERTS NEEDED – HELP! (15)

Vocabulary

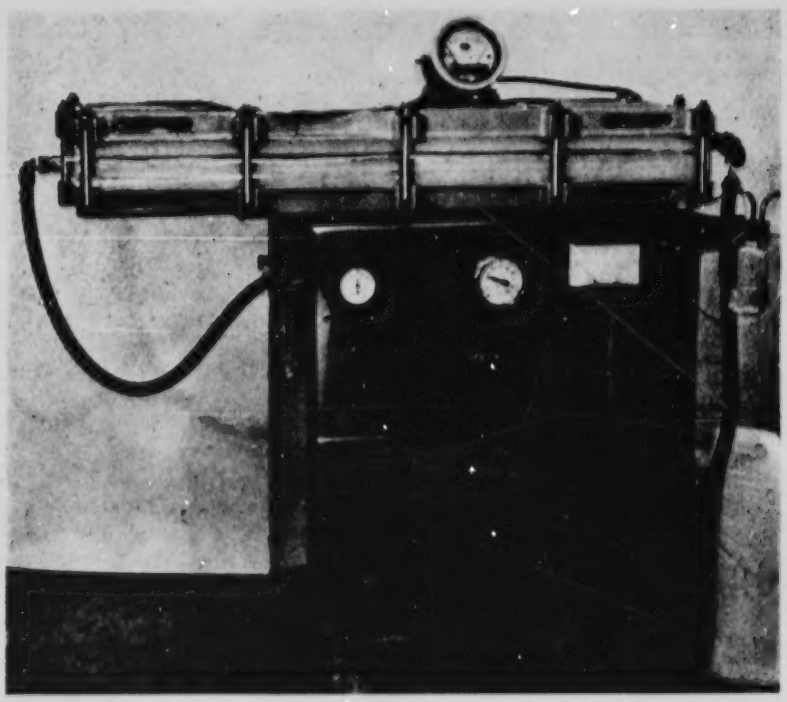
chronic – lasting a long time, constant
The doctor told him rheumatism was a chronic disease.

desperation – willingness to run a risk, recklessness caused by despair
He jumped out of the window in desperation when he saw the stairs on fire.

subsidiary – a company having over half of its stock owned or controlled by another company.
The bus line was a subsidiary of the railroad.

Service work on artificial kidney machines is going to require somebody who has a good working knowledge of electricity, controls, pipefitting, motors . . . we don't have to go any further, because we're talking about a typical refrigeration service engineer.

During the last ten years there has been almost an explosive growth in the development and use of artificial life-support systems, particularly the "artificial kidney." Artificial kidney systems are now found in the home, hospitals, and clinics throughout the United States and Canada. They have the potential of saving an estimated 25,000 people per year who otherwise would die due to *chronic* kidney failure. However, the development and use of artificial kidneys has far outstripped the ability of any given area to provide adequate mechanical service.



To begin with, there simply weren't any service companies available for this type of work. Companies specializing in servicing hospital-type equipment, with particular emphasis on these artificial life-support systems, are just now beginning to appear, but only in a few of the major cities.

When Seattle Artificial Kidney Supply Company, which is a *subsidiary* of the Sweden Freezer Manufacturing Company, first entered into the production of artificial kidneys, it was impossible to obtain satisfactory field service once the equipment was installed and placed into operation. It is not practical to attempt to service this equipment from a factory source so, almost in *desperation*, they turned to the refrigeration service industry, beginning with the Sweden Freezer Authorized Service Group, which was already established throughout the United States and Canada.

Eventually, there undoubtedly will develop an adequate service organization, devoting 100 percent of its time to this type of equipment. Until this is done, the refrigeration service industry can be proud that it has stepped into this gap during the past few years and has done an excellent job of servicing artificial kidney systems.

About the Article

1. What knowledge does a refrigeration service engineer possess that makes him a good candidate for servicing artificial kidney machines?
2. What problem has arisen from the rapid growth in artificial kidney machines?
3. How did the refrigeration service industry step in and help solve the problem?

About Words

Match the base words with the prefixes *dis, un, non* and *in,* to make other words you know.

own	worthy
capable	expensive
experienced	respectful
satisfied	stop
employment	agree
approve	active
	worthy

How has the addition of these prefixes changed the meanings of the words?

More Suffix Review

Using the base word, choose the correct suffix to form a new word to complete each sentence

honor *fy; able; ment; ary; ty*

1. Teaching is an _____ profession. The Senator was awarded an _____degree.

2. form *ence; ous; less; ation; hood*
College football uses the "T" _____ as its standard offense.
From _____ clay the great artist was able to create a masterpiece.

3. critic *ant; ize; ance; al; ible*
The man performed the best he could in the _____ situation so I will not _____ him for his actions.

4. produce *er; ful; ous; tion*
In order to increase _____ we went to a nine-hour work day.
Today we are the largest _____ of floating soap.

5. discover *er; ate; en; ous; able*
The country was named after its _____ .
Easter egg hunts are fun, particularly when the eggs are not easily _____

Activity

1. The article states that the refrigeration service industry can be proud of the way it stepped in and filled the gap caused by the increase in the need for artificial kidney machine servicing. As a student who may someday enter this industry, you should share in this pride. Along with pride comes responsibility. What do you see as part of your responsibility in maintaining this pride for the industry?

2. Do you know the principle behind the kidney machine? Find out!
Do some research into the kinds of diseases that might make the use of the kidney machine necessary.

INFLATION . . .A CHALLENGE TO THE SERVICE ENGINEER (16)

Vocabulary

cliché – a timeworn idea or expression
"Save some money for a rainy day" is a cliché which has a great deal of meaning to many of us today.

excessive – too much; too great; going beyond what is necessary or right
Wise people will not buy when prices are excessive.

nuisance – Thing or person that annoys, troubles, offends, or is disagreeable
Flies are a nuisance.

undoubtedly – beyond doubt; certainly
Because of all the evidence presented in the case, the jury decided that the man was undoubtedly guilty.

versatility – ability to do many things well
His versatility as an infielder made him a valuable addition to the baseball team.

Inflation affects everyone, including the refrigeration and air conditioning service engineers. As future service engineers, a knowledge of how to fight this inflation may make its impact less severe.

What can you do to combat inflation? Read and find out.

(1) It is common knowledge that some of the factors which produced or stimulated the present inflationary spiral are material shortages (whether real or artificial), rising interest rates, dollar devaluation, rising taxes, rent and utility costs, and *excessive* government spending in non-recoverable areas.
(2) Shortages result in higher production costs which, in turn, are passed on to the consumer. Rising interest rates eventually are reflected in higher consumer costs if normal profit margins are to be maintained. On-again, off-again wage and price freezes have proven negative, not positive in their results.
(3) However, every dark cloud, to quote a timeworn *cliche'*, has a silver lining. As future refrigeration service engineers, you should be made aware of how the service engineer can use his knowledge and *versatility* to take positive and productive steps to turn back the inflationary tide and its effect on our operations. With equipment costs going up and real income going down, many potential buyers will not be able to afford to replace present equipment and will be forced to consider having existing equipment repaired.
(4) The rebuilt equipment market will *undoubtedly* broaden in scope and become an important income-producing factor.

(5) Individuals with limited incomes will find it necessary to have existing equipment repaired instead of replaced and, accordingly, your time as a service engineer will be more valuable. You will have to make wise use of this time during the inflationary period ahead by keeping unnecessary calls at a minimum. Transportation will be an important consideration, since vehicle upkeep and maintenance will be high as will the cost of gasoline, if the present attitude of oil producing countries continues.

(6) Make better use of the telephone as a diagnostic tool. It provides your customer an opportunity to help himself. For example, you can suggest that he check the possibility that the equipment in question is not connected or plugged in, or that a blown fuse is causing the malfunction. However legitimate, charges for *nuisance* calls do not foster good customer relations.

(7) Use the phone also to gain specific information regarding the problem posed, in order that proper tools and replacement parts can be taken on the first call, possibly eliminating loss of time, profit, gasoline, and temper which could result from a second call.

(8) It is good business to explain to your customer some of the differences between operation of a new system or individual equipment as compared with previously installed equipment to which he or she may have become attached, its inefficiency and probable higher operating costs notwithstanding.

(9) Your image as an expert in your field will be infinitely more pleasing to your client as a result of your pointing out the importance of simple maintenance to efficient operation of existing equipment – in particular, following instructions in his owner's manual.

(10) This approach will go a long way in gaining your customer's respect and insuring future business. He will most assuredly remember your name and service shop when friends have a service problem.

(11) Like weather, economic trends are unpredictable, and there are apparently no simple solutions to the problems of inflation. However, with careful planning and productive application of time and talent, you can look forward to a bright future regardless of economic conditions.

About the Article

Preparing an Outline

In preparing an outline it is best to begin with individual paragraphs and work through the reading selection, picking out main ideas and supporting details.

In the first paragraph of this selection, the main idea would be factors which produced or stimulated the present inflationary spiral. This main idea becomes your main heading and is marked with a Roman numeral.

I Factors Which Produced or Stimulated the Present Inflationary Spiral
- A. Material shortages
- B. Rising taxes and utility costs
- C. Rising interest rates and dollar devaluation
- D. Excessive government spending

A, B, C, and D represent the subheadings which help to recall important details about the main idea.

Using the above as an example, outline the following paragraphs. The Roman numerals will increase I – II – III – etc. as you move through the paragraphs:

Paragraphs 3, 5, 6, 7, 8, 9.

Now that you have prepared an outline of the article, prepare questions that can be used as a study aid.

Example – paragraph 1:

What were factors which produced or stimulated the present inflationary spiral?

Outlining in this manner and preparing questions based on the outline can help you in studying other subjects, such as history and science.

About Words

In the paragraphs indicated, find the words that best express the *opposite* meaning to the words below. This is the *antonym*. The numbers in parentheses refer to the corresponding paragraph numbers.

not enough (1)
real (1)
decreasing (2)
insignificant (4)
essential (5)
loss (7)
novice (9)

"Every dark cloud has a silver lining" is just one of the many cliches' that are part of our language.

List five other cliches' that you are familiar with. Explain the meanings they are trying to express.

Activity

Do a report on how inflation has affected every aspect of our lives. (Include things such as purchasing power, production, education, etc.)

FREIGHT CARS ENTER THROUGH HUGE FREEZER DOORS (17)

Vocabulary

adjacent – lying near or close; adjoining
The house adjacent to ours has been sold.

ambient – surrounding; encircling; encompassing
The ambient temperatures altered the conditions in the poorly insulated home.

diverse – different; varied
A person of diverse interests can talk on money subjects.

perishable – liable to spoil or decay
Fruit is perishable.

rigorous – very severe; harsh; strict
In prison there is very rigorous discipline.

(1) Fruit Growers Express Company, Washington, D.C., builds and maintains temperature controlled freight cars for a group of railroad companies. Because these cars are called upon to transport *perishable* commodities from coast to coast through *diverse* temperature extremes, the ability to maintain near constant in-car temperatures is vital.

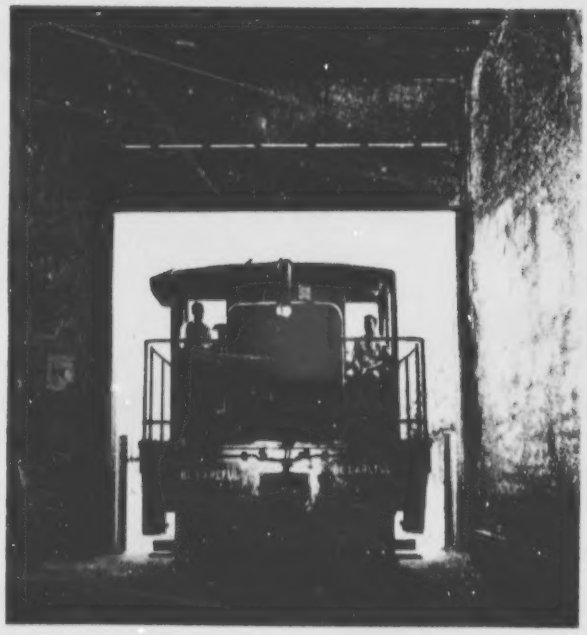
(2) To assure the effectiveness of car insulation and refrigeration and heating equipment, Fruit Growers Express conducts a *rigorous* test program, utilizing a unique test room, specially constructed at its Alexandria, Va. facilities.

(3) The test cell, insulated with four to five inches of spray-on foamed-in-place polyurethane, is 85′ long, 20′ wide, and 23′ high – large enough to accommodate today's longest freight cars with room to spare.

(4) Access to the cell is provided by a seven-leaf power-operated Mark II overhead freezer door, measuring 14′ wide by 18′ high. The unit is protectively clad with #26 gauge galvanized steel. Each door leaf is filled with four inches of polyurethane insulation with a K factor of 0.135 at 75°F.

(5) Hardware, track and steel supports for the door are corrosion resistant. Thermostatically controlled heat cables have been installed in the sill to prevent the formation of ice at the gasket contact area. Gasketing is rubber and neoprene, and can be adjusted to assure leakfree contact.

(6) The door's effectiveness as a thermal barrier is of the utmost importance since temperatures inside the test cell



can range from - 25°F to 150°F. In fact, it is this capability to test from extreme low to extreme high temperatures at one location that distinguishes the Fruit Growers Express facility as one of the few in the country to perform these functions.

(7) Cars to be tested are shuttled into the test room by means of a railyard locomotive. The door is closed by means of pushbutton control, and temperature sensing probes are placed inside the car and at various points throughout the cell.

(8) Following an equalizing period, refrigeration supplied by direct expansion units with nominal 80 ton total capacity brings the interior of the cell down below 0°F. Temperatures are continuously monitored by the sensing apparatus and recorded in an adjacent control room, indicating how well the car can maintain constant interior temperatures while being subjected to severely cold exterior conditions.

(9) Upon completion of the cold room phase, temperatures inside the room are returned to ambient, and can then be raised by electric resistance heaters using 80 KW of power to exceed those temperatures encountered during summer in the hottest areas of the nation. Again, the sensing units will report on the ability of the car to maintain constant inside temperatures needed to protect commodities from spoilage.

About the Article

1. What does the Fruit Growers Express Company do?
2. What is involved in their testing program?
3. How is this program carried out?
4. Why would such a testing program be of such importance to fruit growers?

About Words

Find a word in the paragraph indicated which would best fit in each of the following sentences. The numbers in parentheses refer to the corresponding paragraph numbers.

1. Air conditioning in our own homes keeps the temperature at a _____ 72°F. (1)
2. His _____ approach to art was a refreshing change. (2)
3. The auditorium can _____ 2500 people without violating the fire laws. (3)
4. The students _____ their schedules to have more free time in the afternoon. (5)
5. During the convention I _____ two old friends of mine. (9)

A word can sometimes be either a verb or a noun, depending on how it is used in a sentence.

The words *probe*, *report*, and *contact* are words of this type.

Find these words in the article and indicate whether they are being used as nouns or verbs.

How does the meaning of each change when used as a verb or noun?

Write six sentences for each word, using the word as a noun in three sentences and as a verb in three sentences.

Can you think of three more words like these? List them and use them in sentences as you did above. Explain their meanings.

Activity

Transporting food in refrigerated train cars or truck cars allows us to enjoy foods that we otherwise either couldn't have or could only have during certain times of the year.

Can you think of any such foods? How would our diet be limited if not for these refrigerated cars? Explain.

HOW TO CUT HEATING, COOLING COSTS BY HALF (18)

Vocabulary

emphasize – give special force to; stress; make important
He emphasized that word by saying it very loudly.

exposed – left unprotected; uncovered
Because their feet were exposed to the cold so long, they became frostbitten.

foliage – leaves
Vermont is noted for its beautiful foliage during the autumn months.

remedy – a means of removing or relieving diseases or any bad condition
The President believes that raising import taxes on oil can serve as a remedy to our dependence on it.

A home using presently available energy-conserving products and materials can cut the cost of heating or air conditioning by nearly half. It was *emphasized* that the same kinds of precautions taken to save heat will also serve to keep the cool in.

Contrary to the belief of builders and the home buyer, only a third of the heat and cooling in a home is lost through the walls, ceiling, and floors. Just adding more insulation won't do the trick.

Research on an actual home under the guidance of the University of Minnesota indicates that the greatest heat and cooling losses come from air change. Heat and cooling losses broke down as follows:

Air changes	39.6%
Windows/doors	27.0%
Ceiling/roofs	12.8%
Walls	15.2%
Floors	5.4%

Air change losses come through leaks around windows, doors, through the siding, fireplace dampers left open, electrical ceiling fixtures, around plumbing and pipes, and through kitchen and bathroom fans which often jam open.

Building authorities report that only a 10% to 15% air change is required for normal ventilation. Anything beyond 15% is wasteful.

To reduce air leaks to this figure, inexpensive *remedies* can be applied. They include sealing all cracks carefully, selecting doors and windows with quality weatherstripping, installing hydraulic door closers on every exterior door, and checking to see that fireplace dampers, kitchen and bathroom fans are closed effectively.

Window and door leakages can be reduced by using insulating glass, storm windows, and louver type screening. Drapes and shades can be closed in summer, and natural *foliage* can be used for shading.

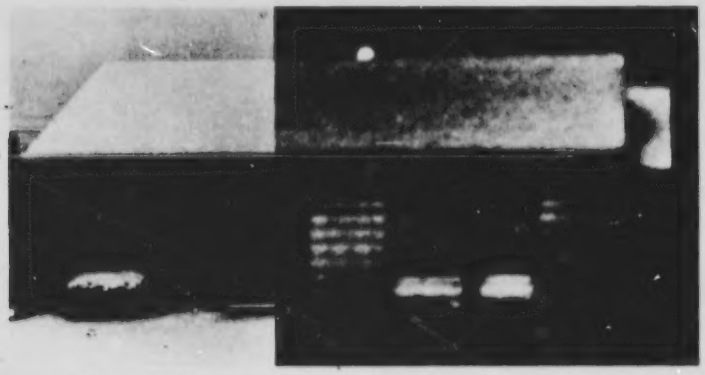
Walls should be insulated with 3 to 3.5 inches of quality insulation between stud spaces. Studs, too, should be insulated.

To reduce loss through ceilings and roofs, insulate the space above the ceiling and between *exposed* rafters with 6 to 10 inches of insulation, ventilate the attic space with substantial fans, and use light-colored roofing materials.

To reduce loss through floors, insulate heating and air conditioning ducts, and insulate the floor itself, including slabs, basements, and crawl spaces.

If these helpful suggestions are followed, more energy will be saved, less money will be spent, and you'll be cooler during those hot summer days.

Photo system detects heat loss



AN EXPERIMENTAL PHOTOGRAPHIC TECHNIQUE has been developed by Owens-Corning Fiberglas Corp. to help in designing better home insulation systems. Here, the lighter shades captured by the infrared camera show heat loss in a poorly insulated home. Properly insulated, the sidewalls would show darker than windows and doors.

About the Article

1. What is a misleading belief that some builders and homebuyers have?
2. What is the correct order of cooling and heat losses, beginning with the greatest and ending with the least?
   a. ceiling/roof
   b. walls
   c. air change
   d. floors
   e. windows/doors

3. Only a _____ % to _____ % air change is required for normal ventilation.

4. What suggestions are made to reduce air leaks from windows and doors, ceilings and roofs, and floors?

About Words

By adding the proper prefix or suffix, make a word that means:

a. one who builds
b. not expensive
c. not natural
d. one who employs
e. present now
f. not available
g. one who researches
h. cautions taken beforehand

Activity

How well is your home protected against heat and cooling losses?

Do a thorough investigation in your home to find this out. Do something about it!

Money invested now to prevent heat and cooling losses can result in big savings in the future.

DOES AIR CONDITIONING IN A HOME AFFECT THE QUALITY OF LIFE THERE? (19)

Vocabulary

adverse – unfavorable; harmful
Putting a young teenage offender in a jail cell with hardened criminals may have an adverse effect on his rehabilitation.

asthma – a chronic disease that causes difficulty in breathing
Because the young boy had asthma, he was unable to participate in many athletic activities.

critical – full of danger or difficulty
A critical moment occurs in a person's life when he must make a decision about his future vocation.

neglected – given little care or attention, left undone
The maid neglected her work.

resume – begin again
Resume reading where we left off.

sultry – hot, close, and moist
We expect sultry weather during July.

People who measured air contaminants were disappointed that these contaminants were not significantly lower in air conditioned buildings than in non-air conditioned buildings.

Let me add my thoughts about the quality of life in an air conditioned home.

I installed central air conditioning in my home in the spring of 1959, primarily because number two son, Jack, had a bad case of asthmatic allergies. He was nine at the time.

Even without an electronic air cleaner, the relief was amazing. He could sleep at night without that old man's wheezing that we had listened to in the spring and summer.

Four boys grew up in this house, and a daughter came along in 1961. I remember many hot evenings where we played games, wrestled, kidded around, or just talked at times when the heat, humidity, or insects would have made us lazy or out of sorts.

Over the 15 years, Jack's *asthma* has improved so much with very little medication that he is hardly bothered at all now at the age of 25.

The air conditioned atmosphere probably kept us indoors on those *sultry* evenings, and needless to say, as some people would believe, it did not have an *adverse* effect on family development.

At the *critical* 10- to 20-year old stage, a family needs something to keep the kids from scattering all over the neighborhood. Our five children have grown up to be very good friends with each other – yet they have each developed their own circle of friends, too.

For 25 years we have taken camping vacations, mostly in the summer, from Cape Cod to Yellowstone Park, and from Florida to British Columbia, and not once did anyone suggest staying home with the air conditioning.

My wife loves to garden and has not *neglected* the garden because of air conditioning. In fact, she has worked in the garden for hours on a hot day, knowing that she could get cooled off whenever she wanted to.

The fact that I leave my storm doors and windows up all year has provided a few other benefits, too. The babies always slept well because the house was so quiet. We have had a very minimum of wall washing and drapery cleaning in spite of the five dust raisers running around the house.

On hot, buggy evenings it's always interesting to see the hundreds of insects buzzing around between the screen and inside window in the few places where I have put screens. Without air conditioning, these insects would be inside our house. We never lacked for fresh air even without an air intake, because of our five little automatic door openers.

With a basketball court in the driveway and a vacant lot next door, we have had lots of neighborhood kids playing in the area. When they became hot and tired, everyone would come in for a soft drink or lemonade, cool off, then go back outside and *resume* the game. As far as I know, no one ever became ill from the changes in temperature. The neighborhood kids certainly liked our house!

After 13 seasons of operation, I finally had to replace the condensing unit last summer. During those years, we had only three service calls that involved anything other than a blown fuse.

Two of the boys are married now and the other two are in college, and they are all fine young men. We look upon our air conditioning system as a friendly helper to us in raising our family.

So don't be disappointed about the results with air contaminants. As far as I am concerned, noise, dust, insects, humidity, and angry words are also air contaminants, and the air conditioning has helped to keep these under control.

About the Article

1. What was the result when the effectiveness of air conditioners to remove air contaminants was measured?
2. Why did the author decide to install air conditioning? What was the result?
3. What effect did the author feel air conditioning had on family development, vacations, other outdoor interests, and general house maintenance?
4. Has owning an air conditioner been much of an expense? Explain.
5. What forms of pollution has air conditioning kept under control?

About Words

Read the following sentence:

Bring books.

This sentence gives us very little information. What kind of books? How many books? Let's see what happens when we add words that describe, or *adjectives*.

Bring *two ninth-grade grammar* books. Now the sentence is clear.

In the article you will find words that describe. Pick out of the article 20 of these adjectives. What words are they describing? What questions do they answer – which one, what kind, how many, etc.?

Activity

There are serious questions which must be given a great deal of consideration in this time of energy shortages. Is it necessary to have air conditioning in a home? The author has some strong opinions on the subject. Do you agree with him?

MIXING REFRIGERANTS – A VERY REAL PROBLEM (20)

Vocabulary

consulting – seeking information from
By consulting our school's unabridged dictionary, I was able to find the meanings of words not found in the classroom dictionary.

converted – changed, transformed
The machines converted cotton into cloth.

durable – lasting a long time
Another reason gold is so valuable is that it is an extremely durable metal.

previously – occurring at an earlier time
Before joining our club, he was previously a member of several other ones.

prominent – easy to see
A single tree in a field is prominent.

stench – a very bad smell
The stench caused by a rubber factory in the local area aroused the population to protest violently.

substituted – put in place of another
We substituted brown sugar for molasses in these cookies.

A case of mistaken identity as applied to refrigerants is rapidly becoming a problem in the field servicing of air conditioning and refrigeration equipment.

In the "good old days" when sulfur dioxide and ammonia were the basic refrigerants it was most unlikely that the service engineer would ever make the mistake of mixing refrigerants. As any old timer can relate, sulfur dioxide carried its own "label" in a powerful *stench*, which caused man, beast, rodent, and insect to flee for their lives. The same held true for ammonia.

With the advance of science came a host of safe, odorless, refrigerants which expanded the horizons of the refrigeration industry and made life much easier for the service engineer. The small price he had to pay for all this was an increase in complexity due to the greater number of refrigerants and the need to avoid mixing refrigerants.

The problem first showed up shortly after World War II when refrigeration systems designed for methyl chloride were *converted* to R-12. The hazardous nature of methyl chloride was recognized at the time, but R-12 was in critical supply just prior to and during World War II so methyl chloride was used as a temporary substitute. After R-12 became available again, methyl chloride was phased out. But during this changeover period some mixups did occur when R-12 was added to systems containing methyl chloride and vice versa.

In the years following World War II, R-22 became a popular refrigerant and to a great extent displaced R-12 in low temperature and small tonnage air conditioning equipment. Soon the service engineer became conditioned to expect R-22 in residential air conditioning systems and in low temperature applications. Occasionally, under the pressure of the summer rush, he would be embarrassed to discover that the system he just charged with R-22 was not functioning properly since it was one of the few holdouts still requiring R-12 or perhaps R-500.

Of course, refrigerants should never be mixed in a system, and one refrigerant should not be substituted for another without determining beforehand whether any of the components need to be changed.

The problem has become even more complicated in recent years with the introduction of the azeotropic refrigerants such as R-502. These refrigerants make available to the service engineer a powerful new tool to tackle some basic system problems which *previously* had no solution. These include lowering the discharge temperature in low temperature applications and increasing system capacity without changing the compressor. Undoubtedly, their use in the future will increase.

This means that the engineer who services a broad spectrum of equipment can no longer take his refrigerants for granted. With some fifteen refrigerants in use and new refrigerants being substituted for the original ones, he must be on the alert to avoid mixing refrigerants. By the use of pressure-temperature charts and by *consulting* the markings on the expansion valve and the equipment nameplate, the correct refrigerant must be determined before connecting a charging drum. In this connection, whenever one refrigerant is substituted for another, it is important to delete the old markings on the nameplate and compressor and substitute the new ones.

As an additional aid, it is suggested that refrigerant manufacturers furnish a small tag with each can of refrigerant. This tag would be made of *durable* plastic, color coded to match the particular refrigerant and stamped with the refrigerant number. The service engineer would attach this tag to the suction line immediately adjacent to the charging port. This would serve as a *prominent* identification tag for the next man who services the equipment.

About the Article

1. Why was it unlikely that a service engineer would mix sulfur dioxide and ammonia?
2. How did the advance of science complicate the life of the service engineer?
3. What incident is given in the article as an example of the problems caused by the number of new refrigerants on the market?
4. What is R-502?
5. Now that refrigerant mixing is a definite problem, what steps should be taken to help alleviate the problem?

About Words

In the article the author writes about what occurred before and after World War II.

Certain prefixes are used to indicate "before" or "after."

pre – before prepay – to pay before
post – after postgame – after the game

What are the meanings of the following words:

preconceive
postgraduate
postwar
prenatal
preface
prediction
posthumous

Use each one in a sentence.

Post is not only a prefix, but it is also a word with many different meanings.

Give the meanings of *post*, depending on how it is used in each sentence.

This summer I will work for the *post* office.

The school will *post* the new dress code in the cafeteria.

I hung my hat on the bed*post*.

Activity

1. Many people believe that scientific advancement along with improved technology has in the long run caused problems that might not be worth the price of modern conveniences and comforts. Do you think that things like water and air pollution, destruction of our natural beauty, and depletion of our natural resources is worth the conveniences and comforts of our modern world? Present your ideas in a well thought-out composition.

2. Following the suggestion of the article, make tags to identify the refrigerants being used in your shop. Be sure to attach these tags to refrigerants presently in systems.

AUTO AIR CONDITIONING SERVICING REQUIRES A PROFESSIONAL (21)

Vocabulary

accessible – easy to reach or enter
A telephone should be put where it will be accessible.

component – an essential part
Blade and handle are components of a knife.

decompose – separate (a substance) into what it is made of
The prism decomposed the sunlight into its various colors.

geyser – a column of hot water and steam
Geysers are popular tourist attractions.

increment – increase
An increment of 300 dollars was awarded to the young employee because of his outstanding performance in his first year on the job.

(1) The air conditioning system has become an important item for the service station, with more than five million new units going into cars, trucks, and mobile homes every year. Right now there are about 40 million such air conditioning units in use. By 1980, seven of every ten vehicles will have air conditioning, and an increasing number will be serviced by independent garages and service stations.

(2) The challenge of this growing market is to convince the motorist that servicing must be left to the professionals. Even the experienced serviceman must be cautioned to approach these units with care. Basically he should be reminded constantly that air conditioning servicing is a chemical rather than a mechanical field; and the more he remembers the principles involved, the less likely he is to run into problems.

(3) The principles of cooling in an automobile air conditioning system are not any different from other applications. The basic *components* of the system and its operation are the very familiar ones you work with every day. There is a compressor, which builds up pressure on the refrigerant and heats it so much that it must be cooled. Cooling it under pressure liquefies the gas. This is done in front of the engine radiator in a condenser. Liquid that results is still under high pressure, and it is held in a receiver, usually near the top of the condenser in a readily *accessible* and visible location.

(4) The cooled, pressurized liquid then flows through piping or hoses back either to an expansion valve or a capillary tube. Vaporization at lower pressure cools the liquid, which is then circulated through the evaporator. Here the air in the car is cooled.

(5) The refrigerant gas completes its cycle by going through larger piping from the evaporator back to the compressor.

(6) To make the equipment effective yet small enough to fit in a car, the most effective gas is R-12, which condenses to a liquid at fairly "warm" temperatures when under pressure.

(7) A sight glass permits inspection of the refrigerant. This is usually located downstream or on the high-pressure side of the condenser.

(8) Some bubbling is normal when the system is first started, but a solid stream of liquid refrigerant should show in the glass after a minute or two of operation.

(9) Since safety is the most important thing, always keep in mind that force built up by the compressor is many times greater than that of a *geyser* that erupts from a radiator cap. Fill the system on the low-pressure side and only after a pressure check with a gauge.

(10) The order of events is:

(a) Attach a pressure gauge to fill valve on the low-pressure line or on the compressor inlet side.

(b) Check pressure in the system.

(c) Start engine and compressor; be sure connection is on low pressure side.

(d) Using approved high-pressure charging hoses and tapping device, connect can to the low pressure side. Never connect can to fitting with pressure over 150 per square inch or to high-pressure side of compressor.

(e) Discard empty car..

(f) Recheck pressure in system to be sure it's within manufacturer's specified limits for low pressure side.

(11) There are safety reminders, too: Don't spill or touch the liquid. The smallest drop on your skin can cause frostbite.

(12) Of course, it's urgent that you remember to keep the cans away from heat. Never apply heat in any form to cans to get the "last trace" out.

(13) Always discharge the refrigerant from the air conditioning system if the car is going into a paint oven or if welding, brazing, or steam cleaning are going to be done near the system. Always discharge the refrigerant system into an exhaust fan or through an open window or door. Never discharge near an open flame, since direct flame can *decompose* the refrigerant chemically, causing the formation of irritating toxic products.

(14) Protect your eyes. Liquid refrigerant in your eyes could cause blindness. If an accident should occur, flush eyes immediately with plenty of running water for at least five minutes. Call a doctor at once.

(15) Since the engine is running while you charge, watch out for the fan belt. Watch out for carbon monoxide. Be sure the exhaust gas vents are outside and you have plenty of fresh air.

(16) Be sure you charge the low side. If you use a dyed refrigerant be sure to charge liquid and use a fender cloth to protect painted surfaces.

(17) Charge in several quarter-pound *increments*, rather than all at once.

(18) Follow all charging instructions and safety suggestions on the car.

About the Article

The topic sentence states the main idea of a paragraph.

1. Write the topic sentence in each of the following paragraphs. Under each topic sentence, list the supporting details.

paragraph 1
paragraph 2
paragraph 3

2. Why is R-12 the most effective gas to use in auto air conditioning systems?
3. What is the function of the sight glass?
4. Why should one avoid touching liquid refrigerant or getting it in one's eyes?
5. What other problems does a service repairman working on an automobile air conditioning system face?
6. Without referring back to the article, list the order of events in filling an automobile air conditioning system. Include in your list the reasoning behind the precautions included in the list.

About Words
Confusing Words

affect -- effect

Affect is a verb meaning to act upon, to influence or produce a result on, or to stir the emotions of.

His lack of participation in class will affect his grade.

Effect used as a verb means to bring about a desired result, to accomplish, to make happen. As a noun it means result, influences, something made to happen.

The use of solar energy may effect changes in the cooling industry.

The effects of fallout are still not fully understood.

Use the correct word in each sentence.

1. Injury to the star player will_____the outcome of the game.
2. The_____ of Watergate is still being felt in government.
3. We are always working to_____ new solutions to our energy problems.
4. The farmlands clearly showed the_____ of the drought.
5. Experiments with the new drug show surprising_____
6. We were all_____ by such a heartwarming speech.
7. Don't let Harry_____ your decision.
8. The introduction of atomic weapons_____ our entire concept of warfare.
9. Its varying_____ are difficult to ascertain.
10. Your attitude can_____ your relationships with others.

Write 5 sentences using the word *affect*.

Write 5 using the word *effect*.

Write the word in each paragraph that has a meaning most nearly the opposite of the words below. The numbers in parentheses refer to the corresponding paragraph numbers.

1. immovable (1)
2. amateurs (2)
3. solidifies (3)
4. forbids (7)
5. unnecessary (12)

Activity

The word "professional" in reference to a trade means different things to different people.

When it is said about someone that he is a real professional, what characteristics do you think this person possesses?

In a paragraph or two, describe the professional as you see him.

AIR CONDITIONING VS FUEL CONSERVATION (22)

Vocabulary

bewail – complain of

Many citizens bewailed the decision of the city council.

deplete – empty; exhaust

Because the traveler's funds were depleted, he went home.

enervating – that which lessens the vigor or stength of

The enervating heat of summer slows the pace of life in a small midwestern town.

Air conditioning was never intended to be chilling. Only American custom has dictated temperatures so low in many cases that workers sometimes have to step outdoors for a few minutes during the day to get warm. After a time, the higher temperatures [demanded by the nation's energy predicament] will become quite acceptable to most people. **— William L. Helms, president of Hill York, Fort Lauderdale, Fla., quoted in the *Fort Lauderdale News*.**

Air conditioning versus fuel conservation? Paul Wills, associate editor of the Tallahassee, Florida *Democrat*, comes out for air conditioning. On a warm August day in Tallahassee, he penned these observations in his column:

> "These hot humid dog days of summer once again have stirred a warm note of appreciation in my inner depths for that modern genie (jē′ nē) of modern engineering, the air conditioner.
>
> "Out of the depths of this mysterious machinery issues streams of cool air to hold the *enervating* heat of August at bay and keep tired and sluggish blood moving briskly enough at least to hold down a job and pursue some of the more leisurely enjoyments.
>
> "To one who grew up in pre-air conditioned days, it comes as no surprise that nearly one-third of the 68 million American households now have air conditioning and that nearly half the 96 million cars on the road are similarly equipped.
>
> "Tremendous increases on both counts. Tremendous corresponding jump in the total amount of human comfort that exists in the world.

"It's true that here and there a few purists and idealists *bewail* the lack of resistance to air conditioning. To them, the coolness in which we determinedly enclose ourselves shuts out Mother Nature with all her rich appeal to our sight, hearing, and smell.

"They are right as rain. It does wall us comfort-loving cusses off from Nature, including its ever present sticky heat. We'll shut out the others if necessary to keep the heat out.

"It doesn't cut much ice with us either to argue that running the air cooling machinery increases costs and *depletes* the nation's supply of precious fuels.

"Who but the most rock-ribbed, heat-resistant conservationist would rather save fuel than use it to maintain spring-like temperatures throughout the long, hot summer in home, office, school, car and palatial shopping malls? Sure, I set the thermostats under my control several degrees warmer than I used to.

"I'm as ready as the next to do my bit to help out in the fuel crunch. Frankly, though, the machinery still cuts many degrees off the torrid temperatures lurking outdoors. If any feeling of guilt over wasting fuel is noticeable this winter, we'll turn the heater down until the feeling goes away.

"Meanwhile we'll bask without bashfulness in the sheer luxury of home-to-car to office air conditioning."

About the Article

1. How does the author refer to air conditioners?
2. What does he see as the advantages of air conditioning?
3. What facts does he use to support his position on air conditioning?
4. What are the arguments against his point of view?

About Words

Have you ever heard the expression "He leads a dog's life?"
Paul Wills uses other expressions of this type in his article.

a. "dog days of summer"
b. "rock-ribbed conservationist"

Expressions of this type are designed to paint a picture.

What picture do you get in reference to "dog days of summer?"

Describe the kind of person you think would be called "rock-ribbed."

Activity

1. You are a reporter for a local newspaper and you are asked to report on a debate between the author and someone who is concerned about the "energy crisis." Write an article presenting the arguments each might use to defend his position.

2. Survey other students within the school and compile some statistics as to the general feeling over the argument of air conditioning vs. fuel conservation. What is your opinion on the subject?

REFRIGERATION KEEPS HIM IN BUSINESS (23)

Vocabulary

accomplished – done; carried out; completed

By putting men on the moon, the United States accomplished what was once considered impossible.

instability – lack of firmness

The building was condemned because of the instability of its foundation.

subsequent – coming after; following

On the day subsequent to your call, the necessary action was taken.

trend – the general direction; course; tendency

The trend of modern living is away from many old customs.

Before reading this article, give some thought to things made possible by air conditioning.

I'll bet there's one you probably didn't think of – *the clothes you're wearing*!

Before writing me off as some kind of nut, read and see if I'm not right.

With the onset of doubleknit fabrics and bright prints in the textile industry came the *subsequent* problem of how to get these two new *trends* together.

The problem arose because the built-in stretch of the doubleknit fabric is difficult to print due to its *instability* and its raised texture.

One solution was to print the design on special paper treated for heat-transferred dry-process dyeing. This could only be *accomplished* with a carefully controlled air conditioning system necessary for successful preparation of the transfer sheets.

"The temperature must be a constant 70°F. and the humidity index must be an even 52," said David A. Smith, president, Tran-Tex Corp., Springfield, Mass., a firm which specializes in the design, engraving, and printing of heat transfer dye patterns.

He added that a variation of more than one degree would put his business "out of business" until the correct climate was restored.

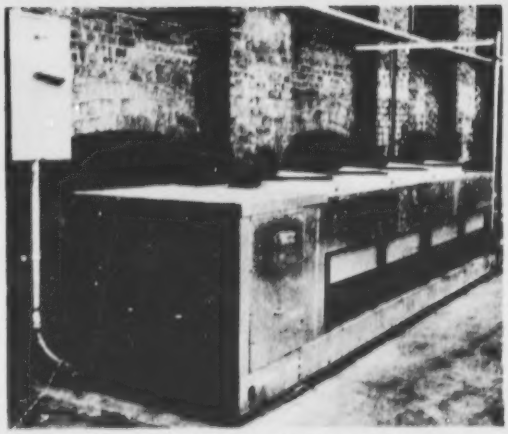
DESIGNS MADE ON SPECIAL PAPER, requiring a constant of 72° and humidity index of 52, hang out to dry.

The equipment necessary to maintain the needed climate control was provided by Halstead and Mitchell. The company's 100 HAH-20 air handler with steam grid humidifier was installed.

Condenser for the system is the PAC 30-H2S20-2 with automatic capacity control.

Smith explained further that the film and the engraving cylinder must fit perfectly. "Any change in temperature or humidity will cause expansion or contraction of the engraved cylinder and the film, keeping them from fitting perfectly. A variation of 0.016" is a major problem," said Smith.

So you see, without air conditioning that beautiful dress you're wearing or that great pair of pants you saw in the store window might never be possible.



HALSTEAD & MITCHELL's PAC UNIT with automatic capacity control aids in maintaining necessary climate control for TranTex Corp.'s technique allowing it to print brightly colored designs for double-knit fabrics on special paper treated for heat-transferred dry-process dyeing.

TRANTEX ENGRAVER corrects an intricate design while the Halstead & Mitchell air handler controls the critical temperature and humidity level.

About the Article

1. What problems have been caused by the popularity of doubleknit fabrics and bright prints?
2. How has air conditioning helped to solve these problems?
3. How does a change in temperature affect the film and engraving cylinder?

About Words

The word element *auto* means self.

Automatic means moving or acting by itself.

In the following words, *auto* is used as a prefix. Guess at the meaning of each word and then refer to a dictionary to see how close your guess was.

autobiography
autograph
autonomous
autosuggestion
automobile

Use each word in a sentence.

Activity

1. *Trend* is a word used in the article in reference to the combination of doubleknit fabrics and bright colors.

   What trends do you see in the world today? (Clothing styles, attitude, morals, etc.) Are these trends unique to our present time or are some repeats of trends during earlier periods of world history?

   What are some trends which you feel are unhealthy to our society today? Explain.

2. In the article the print for brightly colored designs was done on special paper treated for heat-transferred dry-process dyeing.

   Find out what this process involves. Prepare yourself well enough so that you will be able to explain the process to someone else.

OLD IS STILL GOOD (24)

Vocabulary

nostalgia – longing for something far away or long ago
The music of the 50's is part of the nostalgia of the 70's.

replica – copy, reproduction
The artist made a replica of his picture.

Nostalgia, which is becoming more and more a part of our daily lives, has finally caught up with the cooling business.

After 70 years of success, ceiling fans continue to exist, finding as many uses now as they did when they were introduced in the Gay Nineties. Now manufactured by Chromalax Comfort Conditioning Division of Emerson Electric Co., these fans have been renamed the Casablanca series and are showing up on many porches, patios, dens, and stores – even those with air conditioning.

The new surge of popularity is largely due to their ability to puff away insects and smoke with a gentle cooling breeze, making summer time barbecues and get-togethers more fun. Casablanca fans are not *replicas,* but are actual descendents of the 1890's models, which have never been out of production since their introduction.

While today's models retain much of the original appearance, they are much improved. For instance, fan blades on the 36-inch and 56-inch models retain the wood grain appearance of the originals, but are now made of material which resists splitting, cracking, and chipping. The new two-speed motor has a weather-resistant bronze finish, and a lifetime lubricated bearing.

The fans mount to ceilings as low as eight feet and come complete with ceiling hook, insulated hanger, and installation instructions. Nostalgia – no extra charge!

About the Article

1. Ceiling fans were introduced in
   a. 1920's
   b. 1890's
   c. 1870's
   d. 1940's

2. Ceiling fans manufactured today have been renamed _____

3. What has led to the new surge in the popularity of ceiling fans?

4. The ceiling fans of today are replicas of earlier ceiling fans.

   True ☐ False ☐

5. How do today's fans differ from the originals?

Activity

Do research on those times referred to as "the good old days." Each student is to select a topic and report on what conditions actually existed.

Suggested topics

a. heating and cooling systems and comfort
b. health care
c. transportation
d. working conditions

Were the "good old days" really better than today?

HANDLING REFRIGERANTS – HOW SAFE ARE YOU? (25)

Vocabulary

essential – necessary; very important
Good food and plenty of rest are essential for good health.

excess – more than enough
Pour off the excess liquid.

paraphrase – to state the meaning of a passage in other words
Some assignments in English class require that we paraphrase some of the great poems.

promoted – helped to grow or develop; helped to success
World peace is promoted by respect for another man's right to be free.

properties – qualities or powers belonging especially to something
Some soaps have the properties of both removing dirt and softening skin.

It has been said that safety is a state of mind. It is the attitude with which each individual approaches his daily life, both at work and at home. In the practice of safety we are often our own worst enemy – sometimes through lack of knowledge but more often through failure to practice what we know. To *paraphrase* a famous quotation, "We have met the enemy and he is us."

Safety aids are important in keeping the safety record clear. Many potential tragedies have been avoided by wearing gloves, goggles, safety shoes, and proper clothing. Safety is also *promoted* by the right kinds of tools, posted safety rules, recognition of hazards, etc. – but most important of all is a mental attitude that looks for the safe way of doing things.

As a cause of death in the U.S., accidents are fourth behind heart attacks, cancer, and strokes or brain damage. As might be expected, most accidental deaths involve the automobile. No separate data for the refrigeration industry are available.

Not long ago, an authority on safe driving practices said that it was *essential* for the automobile driver to get the "big picture." By this he meant that a good driver is constantly checking to see what is ahead, behind, and to the right or left so he can be aware of possible hazards which might develop in any direction and can take steps to avoid them. This idea is also useful in thinking about safety in any field. Each job should be reviewed from the overall safety standpoint to see that all proper safeguards and procedures are being followed. Each big picture, however, is made up of a number of parts. In the refrigeration and air conditioning industry, one of the parts is the refrigerant.

Although the safety record of fluorinated refrigerants is good, there are possible hazards connected with their use and handling, and they should be recognized.

About the Article

1. How does the author feel that most accidents can be avoided?

2. What are the four major causes of death in the United States?

About Words

In this article the author uses two phrases as an expression of very important ideas. These expressions are: "getting the big picture" and "we have met the enemy and he is us."

Express in your own words what you think these expressions mean.

Relate it to your vocational area.

Activities

Make a check list of safety rules and regulations that you want to serve as a standard for your shop. The class as a whole should agree on these rules and regulations.

Once these are established, make up posters and signs to be placed around the shop as reminders.

Each student is to take responsibility to see that they are followed.

Make Yourself an Expert

Select one of the following 19 questions and do research to find the correct answers.

Prepare an oral report to be given to your classmates. Include in this report your answer to the question along with a thorough explanation. The thoroughness and clarity of your report may help a friend avoid serious injury or death.

1. The manufacturer can ship refrigerants in any kind of cylinder he wants to.
   True ☐ False ☐

2. Refrigerant cylinders should never be heated with an open flame or live steam.
   True ☐ False ☐

3. Cylinders should never be heated to temperatures above: (a) 100°F (b) 125°F (c) 150°F

4. Cylinders are protected against *excess* pressure by:
   a. Soft spot in wall
   b. Nothing
   c. A built-in relief device

5. A pressure relief device protects a cylinder against all possible hazards.
   True ☐ False ☐

6. Returnable cylinders are more rugged than throwaway cylinders.
   True ☐ False ☐

7. The words "nonrefillable" on a cylinder means:
   a. The cylinder should not be refilled by the manufacturer or user.
   b. The cylinder valve will let refrigerant out but not in.
   c. The manufacturer must not refill the cylinder but it is all right for the service engineer to do so.

8. Containers should not be completely filled with liquid because:
   a. They would be too heavy to carry.
   b. If the temperature goes up, hydrostatic pressures sufficient to rupture the container may develop.
   c. There wouldn't be any vapor present.

9. The color of a cylinder is the primary means of identifying the refrigerant it contains.
   True ☐ False ☐

10. One reason fluorinated products have largely replaced older refrigerants, such as sulfur dioxide, methyl chloride, and ammonia is:
   a. They are nonflammable and are low in toxicity.
   b. They cost less.
   c. They produce more refrigeration.

11. Fluorinated refrigerants will not decompose under any conditons.
   True ☐ False ☐

12. Decomposition of flourinated refrigerants does not create a practical toxicity hazard because:
   a. The products of decomposition serve as warning agents.
   b. Nontoxic products are formed.
   c. Refrigeration service engineers are especially rugged.

13. Refrigeration from a system should be discharged outdoors because:
   a. The odor may be offensive.
   b. Possible hazards may be created indoors.
   c. It will make a good impression on the owner.

14. Liquid refrigerant should not be spilled on the skin because:
   a. It tends to cause discoloration.
   b. Some people may be allergic to it.
   c. Evaporation may freeze the skin.

15. Fluorinated refrigerant vapors compared to air are:
    a. Lighter
    b. Heavier
    c. About the same weight.

16. The fact that fluorinated refrigerants are low in toxicity means they are safe under all conditions.
    True ☐ False ☐

17. Refrigerant lines should be purged with nitrogen while welding or soldering.
    True ☐ False ☐

18. Oxygen must not be used for purging or leak testing.
    True ☐ False ☐

19. Ammonia, methyl chloride, and fluorinated refrigerants can be used with any of the common metals.
    True ☐ False ☐

AS YOU USE YOUR TOOLS AND INSTRUMENTS, BE AWARE OF ELECTRICAL SAFETY (26)

Vocabulary

environment – all of the surrounding conditions and influences that affect the development of a living thing.
A noisy environment is not a good one for studying.

extensive – affecting many things, wide, broad
The large explosion caused extensive damage to the sheet metal factory.

resistance – that which acts against or opposes
She has little resistance to germs so she is always ill.

significance – importance, meaning
The practice of safety has particular significance to the refrigeration and air conditioning student.

voltage – electromotive force expressed in volts
High voltage equipment can be dangerous to someone who is careless.

Electrical shock causing death or injury is one of the hazards faced by the refrigeration service engineer. While it is important for all to have a knowledge of electrical safety, the subject takes on particular *significance* for those working in the refrigeration and air conditioning service industry.

This is so because the three main factors involved in electrical accidents at the common commercial voltages are present in every refrigeration installation. The factors are (1) the presence of *extensive* electrically operated equipment (2) the need to service this equipment with a wide variety of power tools and electrical instruments (3) the presence of a wet working *environment* providing a low *resistance* to ground.

Refrigeration service engineers normally work with 60-cycle alternating current under 600 volts, the most common voltages being 120, 208, and 240. This helps narrow the scope of the problem.

High *voltage* power lines are extremely dangerous since the high energy levels available are capable of causing massive nerve and tissue destruction in a matter of seconds. Also, high voltage is treacherous in that it can jump a gap of several feet, if arching conditions are right, and kill at a distance.

The refrigeration service engineer has no need to approach high voltage power lines. He has neither the training nor the equipment to deal with this kind of power, which should be left exclusively to those specifically trained for it.

Severity of electrical shock in a typical electrical accident depends on three factors: (1) moisture on the skin (2) pressure of contact (3) area of contact. This case history of an electrical accident which proved fatal to a refrigeration service engineer will demonstrate this point.

The man was installing a metal walk-in cooler on a hot day. He was perspiring freely. He picked up his electric drill to drill some holes to hang the blower coil. This particular drill was an old model without a third ground wire. In using the drill in the past he had experienced a slight electrical shock, which he ignored.

Bracing his back against the metallic wall of the cooler, he raised his hand with the drill to the ceiling, tightly gripped the handle and pulled the trigger. Instantly a current shot from the drill to his hand, through his chest, and out of his back into the walk-in cooler wall. The man lay there dead.

About the Article

1. Why is it important for refrigeration service engineers to have a knowledge of electrical safety?
2. What are two good reasons for refrigeration service engineers to avoid high voltage power lines?
3. What three factors play an important part in the severity of an electrical shock?
4. List the causes of death by electrical shock as described in the case history. How could it have been avoided?

About Words

The article ends with the words *"The man lay there dead."* The reality of the danger of electrical shock is expressed very strongly with these words.

Express in your own words the impact these words made with you.

Would the impact have been the same if these words were not the very last in the article? Explain.

List other words or expressions that have made an impact on you or others. Explain the kind of impact they have made.

Activity

Check carefully to see that the equipment you are working with meets the standards for electrical safety.

Do research on emergency treatment for electrical shock. Be prepared to report about this treatment to other members of the class.

Be serious about this activity. It may save your life or a friend's!

BEWARE OF THE FREAK ACCIDENT (27)

Vocabulary

contamination – an impurity, being contaminated
Milk should be kept very clean to avoid contamination.

disregard – pay no attention to, neglect
If you disregard the safety rules, your health may be endangered.

ejection – something thrown or forced out
Lava is a volcanic ejection.

explicit – clearly expressed
He gave such explicit directions that we had no difficulty getting there.

feasible – capable of being done or carried out easily
The committee selected the plan that seemed most feasible.

rupture – a break
The rupture of a blood vessel may cause serious internal bleeding.

(1) This freak accident involving improper methods in the use of tubing test plugs points up the need for constant awareness and proper techniques.

(2) Most accidents experienced by refrigeration service engineers can be grouped into two broad categories. The first involves accidents which result from a failure to follow well-publicized safety rules. A good example of this type of accident is one in which the service engineer gets hurt while pressure testing a system with nitrogen, without the use of a pressure regulator. The safety procedure to pressure test with nitrogen is continuously being emphasized in service literature; yet, every year there are a number of deaths and injuries from this one source.

(3) Another example would be an injury resulting from circuit testing on a wet floor without taking the necessary safeguards. Here again the service literature is very *explicit* as to the precautions which must be taken when working in a wet environment. The safety engineer can only be frustrated by the accident victim who chose to *disregard* the safety rules.

(4) On the other hand, there is a second category of accidents where the victim is not forewarned. This is the freak accident – an accident which results from such an unusual combination of events that the victim is taken by complete surprise. The freak accident is difficult to deal with. It is not *feasible* to pack the service literature with the many accounts of freak accidents which a typical service engineer may never encounter in a lifetime of work.

(5) In reading of someone else's experience however, someone at a later date may recognize the "trap" before it is spring.

(6) The accident described here details one of the hazards which make continuous awareness necessary. It occurred during an improper application of tubing test plugs and resulted in an injury to a service engineer's hand.

(7) Tubing test plugs are a convenient tool to temporarily seal off a refrigerant line for testing purposes or to simply keep out *contamination*. In the events leading up to the accident, a service engineer wanted to seal off a five-ton air conditioning condensing unit so he could rerun the suction and liquid lines, which had to be moved because of building renovation. The condensing unit came with a liquid line shut-off valve, but no shut-off valve was provided in the suction line, which was 1 1/8" hard drawn tubing piped directly to the compressor. A valve was tapped into the suction line near the compressor for charging and servicing.

(8) To disconnect the condensing unit, the service engineer closed the liquid line shut-off valve and discharged the gas from the service valve in the suction line. When the pressure dropped to zero, he cut the suction and liquid lines close to the condensing unit and moved the unit out of position. To protect the compressor, he installed a 1 1/8" test plug in the open suction line and tightened the wing nut.

(9) About a week later, the service engineer returned to reconnect the condensing unit. He placed the unit in position and prepared to resweat the suction and liquid lines. The first step was to remove the test plug in the stub tube leading from the compressor. He loosened the wing nut and all of a sudden, without any warning, the plug shot out of the line like a bullet into his hand. The *ejection* was accompanied by a large pressure blast as the refrigerant and oil discharged out of the compressor.

(10) The blast blew up a cloud of dust and covered the service engineer with a film of refrigerant oil. When he pulled back from the explosion, he noticed that his right hand was covered with blood. The blood came from a large number of small skin *ruptures* caused by the sudden discharge of gas and oil, under high pressure, against the skin.

(11) Fortunately, the service engineer suffered no broken bones but only a severely bruised hand.

(12) What happened? The service engineer violated a cardinal rule of safety when he removed a plug from a pressure line without first measuring the pressure in the line. He was misled in thinking there was no pressure behind the plug because there was none when he installed it.

(13) Where did the pressure come from? When the service engineer closed the liquid line, he trapped a charge of gas in the condenser between the liquid line shut-off valve and the compressor discharge valves. In time, this gas was able to work past the discharge valves into the compressor crankcase. In addition, the crankcase released some dissolved gas.

The pressure in the crankcase for an R-22 condensing unit sitting in the sun on a hot summer day can easily go up in excess of 200 psi. This kind of pressure, backed up by a large volume in the compressor crankcase, can turn a test plug in a suction line into a cannon, with potentially disastrous results.

About the Article

1. Into what two categories does the author place accidents?

2. How does he define each category?

Summarizing

The author presents an event which resulted in an injury to a service engineer. The event is described with details not necessary in writing a summary, since a summary is concerned solely with the main ideas or points.

Reread the event, listing what you feel to be the main ideas.

Using these, prepare a summary of no more than five sentences.

Note to the Teacher: Don't take for granted that summarizing is an easy skill to master. Writing good summaries takes practice and a lot of guidance.

A helpful suggestion may be to prepare a summary with class participation and use it as a model. Using this model, students can make corrections and see what was unnecessary in their own summaries.

About Words

In the article the author expresses a comparison between a plug and a bullet when he writes "it shot out like a bullet."

Expressing a comparison between two things using *like* or *as* is called a *simile.* The numbers in parentheses refer to the corresponding paragraph numbers.

He has a face like marble.
He is brave as a lion.

Make 10 other comparisons between two things using either like or as. Explain these comparisons.

Which word in the paragraph will best fit in the following sentences:

1. In order to complete the task properly, a certain _____ has to be followed. (2)

2. The fireman took certain _____ to avoid injury to himself and fellow firemen. (3)

3. In my entire life I may never _____ another person who has had such an influence on me as my father. (4)

4. The city agency ordered _____ of the apartment house before it could be occupied. (7)

5. He was released from the army with an honorable _____ (10)

Activity

Relating a personal experience can be a helpful and educational experience.

Each student should prepare an oral presentation about an accident experienced by the student or by someone he/she knows.

Emphasis on how the accident could have been avoided should be a major part of the presentation.

DEATH TRAPS (28)

Vocabulary

abandoned – deserted, given up entirely
An abandoned refrigerator can be a death trap.

compensate – make an equal return to; give an equivalent to
The hunters compensated the farmer for killing his cow.

contend – declare to be a fact; maintain as true
Columbus contended that the earth was round.

resuscitate – revive
Resuscitation helped bring the man back to consciousness.

revived – brought back to life or consciousness
The withered flowers were revived by giving them water.

unconscious – not aware, not conscious
The boy was knocked in the head with a baseball and fell to the ground unconscious.

Newspapers are filled with accounts of young children being trapped and suffocated inside *abandoned* refrigerators. Many of these accidents could be avoided if not for the carelessness and lack of responsibility of many adults.

Three children, who police say apparently crawled inside an abandoned chest-type freezer, were found suffocated. The mother of two of the children found the bodies of her 6-year-old son, her 4-year-old daughter, and a 5-year-old playmate. The abandoned freezer had an outside lock handle.

In another case, a Federal court jury decided that the parents of two 4-year-old boys who died in a refrigerator left in a yard were more responsible for the boys' deaths than the owner of the refrigerator or the owner of the property. The parents of the two boys were helping another couple move into their new apartment when the accident occurred. Defense attorneys *contended* that the parents of the boys shared the blame because they allowed the 4 year-olds to play outside without supervision.

The jury decided that the parents were 45% responsible for the deaths, the owner of the building was 20% responsible, the owner of the refrigerator was 30% responsible and the municipality 5% responsible. City officials had visited the scene the day before the accident after neighbors complained about the refrigerator, but nothing was done.

Because the owner of the refrigerator had violated a state law that requires the owner of an abandoned refrigerator to remove the door, he received a 90-day suspended sentence.

Still another child died in a refrigerator in the attic of a Detroit home. Two brothers, 3 and 5 years old, were found *unconscious* inside the unplugged refrigerator. A police officer *revived* the 5-year-old, but the other child did not respond to *resuscitation* efforts.

About the Article

The death of any young child is an extremely tragic event. Nothing can *compensate* for it.

1. How could the tragic events described in this article have been avoided?
2. In the eyes of the law, who was held responsible for the death of the two four-year olds? To what extent was each party held responsible?
3. Who do you think should be held most responsible in deaths of this type? Give reasons.

About Words

The prefix *un* means not

unconscious = not conscious

How are the meanings of the following words changed with the addition of the prefix *un*?

1. true
2. dress
3. harmed
4. plugged
5. organized
6. controlled

Use each word in a sentence with the prefix *un* added to each word.

Compound Words

Two words can sometimes be joined together to form one word with its own distinct meaning. Words of this type are called compound words. An example of a compound word is *newspaper*, made up of *news* + *paper* – a paper that reports the news.

In the selection find other compound words. Define each, then divide it into its smaller units.

Think of ten additional compound words and provide a meaning for each one.

Activity

As responsible young adults you should begin taking some interest in the well-being of the people in your community.

Find out what laws govern abandoned refrigerators in your community or state.

Join together as a class and mount a publicity campaign to make members of the community aware of these laws and the dangers of abandoned refrigerators.

Ask your health instructor to provide information on what can be done when a child is found unconscious. Include this information as part of your campaign.

Vocabulary

alloy – an inferior metal mixed with a more valuable one
This gold is not pure; there is some alloy in it.

cumulative – increasing or growing in amount
Education is a cumulative process.

nausea – the feeling one has when about to vomit
Nausea and a severe headache may be symptoms of the flu.

predominantly – mostly
Spanish is predominantly spoken on the east side of town.

symptoms – signs; indications
Quaking knees and paleness are symptoms of fear.

toxic – poisonous
Methane is a toxic gas.

Bright, shiny coils of wire, thousands of them in tool boxes, service trucks, and factories . . . pretty stuff; you could fashion jewelry from it. You could also do a lot worse. You could do a lot of brazing in a poorly ventilated area, breathe in an excess of cadmium fumes, and become quite ill . . . or perhaps die.

The killer is cadmium, an element that has been used in silver brazing *alloys* since the beginning of the cooling industry. We are still using cadmium alloys *predominantly*, and it is time we stopped.

Most of the common cadmium-bearing silver solders are identified as alloys 35, 45, and 50. Some manufacturers use only trade names or other identification. They are easily identified when packaged since a warning label is required. They contain from 18 to 24 percent cadmium.

When these alloys are melted during brazing, a thin, ugly, mustard-yellow smoke is formed over the braze. The yellow smoke is hard to see unless you are looking for it. It doesn't warn you by having a strong disagreeable odor or make you cough while you are breathing it. Cadmium poisoning *symptoms* strike hours later. Headache, fever, chills, throat irritation, *nausea*, vomiting, and diarrhea are the common late warnings. By then it may be a little too late.

One of the more distressing characteristics of the problem is that the effects of breathing cadmium oxide fumes are *cumulative*. The Public Health Service advises that the body does not readily throw off cadmium. A slow buildup can be the result.

The answer is a simple one: employ the wide range of cadmium-free silver solders which have been available for years. Several that are particularly suited for the coding industry contain 40, 45, and 57 percent respectively, with the balance of their composition composed of zinc and copper. The 57 percent silver alloy contains 5 percent tin. They are totally non-*toxic* and completely safe. Although the cadmium-free alloys are generally slightly higher in flow temperatures, they have excellent physical properties and will join the same wide range of metals as will their cadmium counterparts.

What is being done to effect a change to cadmium free silver solder alloys? Not enough.

Let's get the books and specifications rewritten, take the cadmium alloys off the shelf, and get rid of those deadly little coils of wires that are so bright and shiny.

About the Article

1. What is the author's purpose in writing this article?
2. What are the dangers of using cadmium-bearing silver solders?
3. What alternatives does he offer to using cadmium bearing silver solders?
4. What role should the industry take in doing away with this alloy?

About Words

Very often the words in a title are effectively used to catch a reader's attention.

Look at the words in the title of this article.

Did they catch your attention? Why?

What images flashed in your mind in anticipation of reading the article?

In the first paragraph the author uses words to mislead the reader, then "bang," we're hit with the reality of his point. How does he mislead us?

Is this approach effective? Why?

Activity

What state and federal agencies have been established to protect our citizens? List some of them and select one in particular you wish to prepare a report on. The report can be done as either a written or oral assignment.

AMERICA CAN'T FUNCTION WITHOUT THE AIR CONDITIONING INDUSTRY (30)

Vocabulary

dependent – relying on another for support or help
A child is dependent on its parents.

frantic – very much excited
A great deal of frantic behavior became evident when the building suddenly caught fire.

restrictive – limiting
Some laws are prohibitive; some are only restrictive.

sweltered – suffered from heat
The pioneers sweltered in the heat of our midwestern deserts.

tendency – inclination; leaning; a natural disposition to move, proceed, or act in some direction or toward some point, end, or result.
Boys have a stronger tendency to fight than girls.

(1) The present energy emergency could create a panic reaction which would only lead to further hardships, a much lower standard of living, and a totally weakened economy. But it doesn't have to be that way.

(2) Panic is usually the result of being faced with a situation requiring immediate action. If you don't know what to do, you guess, or you ask someone else who doesn't know any more about the situation than you do. You have a *tendency* to throw all your weapons into the battle – whether they would be effective or not. In other words, you feel you must do something – anything – in a *frantic* and sometimes disastrous attempt to cope with the causes of your unreasonable fear. For these reasons, panic reaction is usually totally wrong.

(3) The ugly reality is that the energy crisis is going to affect every service trade, every profession, every worker in America. As a matter of fact, the effects are already quite evident. There are problems – even some hardships – but the country is surviving, and answers to new problems are being found. There is obviously no reason for panic.

(4) One of the major dangers to the air conditioning industry is a panic reaction in the form of excess legislation. Over the past few years the federal government has taken on an increasing degree of industry control which, whether created for useful purposes or not, proves far more restricting than stimulating to a healthful, free economy.

(5) It is extremely important that unnecessary or unwise legislation to lessen the energy shortage be avoided altogether and that the public and elected representatives be totally aware of the importance of air conditioning to this nation . . .now. Maybe not twenty years ago, but now, air conditioning is not a luxury we can easily do without. It is a huge and essential part of our economy, our productivity, our health, and our progress.

(6) Air conditioning has become essential to personal well-being and to the economic life of civilized nations. It is today a $7.1 billion annual business that provides jobs, not only within the industry itself but in countless industries *dependent* upon air conditioning as a necessary part of their production processes.

(7) Air conditioning has made cities grow where towns once *sweltered.* It has changed the face of architecture, permitting the construction of block-square buildings by making cross ventilation unnecessary. It has made summer school practical and popular. It has increased productivity in factories and offices. And it has proven to be helpful to those with allergies and heart disease.

(8) As a result, all new office buildings, all new commercial buildings, most new hospitals, half the new schools, and almost all new college buildings are now built with complete air conditioning.

(9) Without it, the computerized information centers of our business, industrial, and governmental institutions would grind to a halt. Nuclear power plants are dependent upon it to prevent overheating of essential equipment.

(10) Although cooling takes energy, its annual usage for summer air conditioning represents less than three percent of the total U.S. energy consumption.

(11) It is quite evident that almost all aspects of living in the United States today are in some way dependent upon air conditioning. That interrelationship should be a major consideration before any legislation which might be even remotely *restrictive* is written or passed by Congress.

(12) Every effort should be made to make the public aware, because the government is already swinging into action.

About the Article

List the topic sentences in each of the following paragraphs.

Paragraphs 2 – 3 – 4 – 5 – 6 – 7 – 11

The article is obviously written with a biased point of view. Because the article presents a biased point of view, it is filled with a lot of opinion.

Fact is defined as something known to be true or something that really happened.

Opinion is what one thinks about something.

Can you distinguish between what is fact and what is opinion in this article?

Divide your paper into two columns – one for fact and one for opinion. List in each column phrases or details from the article which you consider to be either fact or opinion.

Be prepared to explain your choices.

About Words

Which of the words in the paragraphs indicated would best fit in the sentences below? The numbers in parentheses refer to the corresponding paragraph numbers.

1. The _____ amount of wheat will allow larger shipments to needy countries. (4)

2. It was felt that the new regulations were too _____ so demand for change was begun. (4)

3. A good quarterback is _____ if any team is going to make it to the Super Bowl. (5)

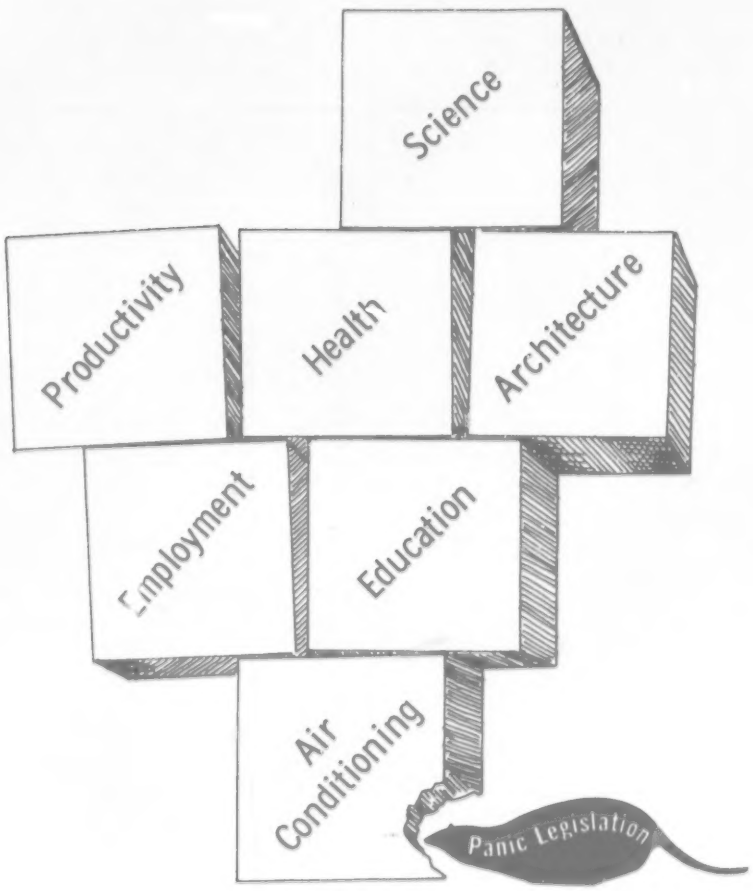
4. The _____ of slavery was the most important outcome of the Civil War. (7)

5. Our present technology is so _____ on fossil fuel that without it it would grind to a halt. (9)

6. The _____ of fuel far exceeds our ability to replace it. (10)

Activity

It has often been said that one picture is worth a thousand words. Look at the picture below and explain how the main ideas of the article are effectively brought out through its use.



UPDATING WITH DYED REFRIGERANT (31)

Vocabulary

capability - ability; capacity
He has the capability of being a great ballplayer.

harried – tormented, worried
Fear of losing his job harried the clerk.

initial – occurring at the beginning; first; earliest
The initial cost of the furniture was $1500 but because of increased labor cost it is now $1600.

proximity – nearness; closeness
His proximity to the scene of the crime made him a valuable witness.

suspected – had an inkling or suspicion; thought possible
The police suspected him of the crime.

Four ways to find leaks: halide torch, dyed refrigerant, bubble solution, and electronic detector

(1) If there is one thing more irritating than an air conditioner that doesn't work in the summer, it might be a leak that can't be easily located.

(2) For years there have been three main leak detection tools to help the *harried* service engineer locate or even pinpoint the site where the invisible, odorless refrigerant makes its getaway. Soap solutions, the halide torch, and the electronic sniffer still do their jobs, but they have been joined by a relatively new development – a dyed refrigerant from DuPont that aids service sequence and establishes some new approaches to leak detection.

(3) The emergence of "Dytel" red leak detective from tests by the manufacturers and servicemen suggests that new combinations of available devices could save up to half the time needed to locate leaks. Even better, the *capability* of modern technology gives service engineers more confidence than ever that even the smallest leaks have not slipped by.

(4) Taken one at a time, here is how the leak detection devices stack up:
Bubble Detector – This can be a factory formulation of a low-tension fluid packed in a squeeze bottle or with a cap and attached dauber. The simplest formulation is soap and water.

(5) To locate the leak, the solution is applied to *suspected* areas. Escaping refrigerant passing through the solution forms bubbles. Careful observation is necessary to catch the *initial* reaction. Heavy leaks or "gushers" blow the foam away so fast it is difficult to catch. With small leaks, bubbles will not reform after initial application, requiring repeated applications and extended observation time.

(6) At best, the system is limited to joints, fillings, flanges and pipes. It is of limited usefulness on hard-to-see surfaces or on shrouded or covered parts like evaporators and condensers. Cost is low, but the technique is not regarded highly for regular leak detection work.

(7) *Halide Torch* – This is the familiar propane torch fitted with a special head containing a copper alloy reaction plate and a pick-up hose. Because of the open flame, and the chance of producing fire or toxic by-products of burning, the work space must be well ventilated and free of gasoline fumes. To prevent the leak from being rapidly dispersed, the engine must not be running.

(8) By moving the pick-up hose around suspected joints and observing the flame color, leaks are located. A blue flame is normal, a greenish-blue flame indicates a small amount of refrigerant, a purplish-blue indicates a large loss. Since Refrigerant 12 is heavier than air, holding the hose beneath the suspected part will give more rapid reading. In handling, the speed of moving the hose must be slow enough to allow the eye to check both hose and flame – and to allow the vapors to ravel through the pick-up hose.

(9) Small leaks from parts in close *proximity* are difficult to distinguish with a torch as are hooded parts which tend to diffuse the refrigerant.

(10) *Electronic Detector* – Frequently this is a gun-shaped device with probe which uses the well-known dielectric property of refrigerant gas as an operating principle. It measures the dielectric differential of air near the possible leak site. The operator hears a buzzer or clicking, or sees a light when a leak is discovered.

(11) Sensitivity of electronic detectors is excellent, and leaks as small as half an ounce per year can be picked up. Big leaks or gushers, however, can overwhelm it and cause it to be desensitized. Another problem is that it can "smell" only one leak at a time – the more dominant one where multiple leaks are present. Repeated checking after repair is necessary.

(12) *Dye* – Two types are now available: Azo and Dytel leak detective. They are added to the system the same way, as a concentrate mixed with R-12. In use, an automotive system containing dyed refrigerant is run up to fast idle (2500 rpm) or road speed. After at least 15 minutes running, the system is checked visually for red dye. Intensity of the color indicates the size of the leak.

(13) Cost of the leak detective is minimal – about 10 percent over the cost of clear refrigerant. No special equipment is required when an entire system is being charged. Savings in time required to locate leaks is claimed by some to be as high as 50 percent. The chance of overlooking multiple leaks is decreased.

(14) The ideal leak detector hasn't been invented yet, although new technology is closing the gap. Realistically, there isn't any one leak detector that can do all jobs best. Two systems, one to search and the other to pinpoint, come closest to being the new ideal. Most favored by experts who have tried them all: the dye leak detective plus a good electronic detector.

About the Article

1. What are the four leak detector devices outlined in the article?
2. Compare and contrast each device, being sure to point out good and bad points.
3. What does the author see as the best device for detecting leaks? Explain.

About Words

Which word in the paragraph would best fit in the sentence below:
The numbers in parentheses refer to the corresponding paragraph numbers.

1. The air pollution was highly _____ to the eyes. (1)
2. The body of the high government official was _____ in the American flag. (6)
3. The police _____ the angry crowd. (7)
4. Because he was present during the time of the crime, he was _____ of being involved. (8)
5. Wilt Chamberlain was the _____ figure in basketball for over 10 years. (11)

More with Prefixes and Suffixes

Underline the suffix or prefix in the following words. Tell how they change the meaning of the word.

invisible
odorless
electronic
relatively
manufacturer
smallest
capable
simplest
careful
extended
disperse
dielectric
desensitized

ELECTRONIC DETECTION ACCURACY (32)

Vocabulary

amplifying – make greater: make stronger
The amplified sound of the electric guitar was very irritating to most of the older folks.

detect – find out; discover
Could you detect any odor in the room?

inflexible – firm; that cannot be changed
Neither threats nor promises could change his inflexible determination.

restricted – keep within limits; confine
Our club membership is restricted to twelve

(1) Refrigerant leak detection in the field is a critical part of maintaining air conditioning and refrigeration equipment. To quickly and efficiently locate refrigerant leaks, the serviceman needs a sensitive, accurate, reliable, and safe detection system that is easily operated and reasonably priced. Chemical dye penetration, halide torch, and electronic leak detection are three methods most widely used in the field. Of these, electronic leak detection best satisfies the serviceman's requirements.

(2) Electronic leak detectors employ a halogen-sensitive element to signal the presence of refrigerant. In more sophisticated electronic leak detectors, the sensor is located in the control unit and a pump draws air through a probe to the element. The serviceman moves the probe along the surface to be tested to find refrigerant leaks. Most detectors signal a leak with either a light on the hand-held unit or a tone in the control unit. When refrigerants contact the sensor, halogen compounds in the refrigerant ionize on the element, increasing the ion current between electrodes. By *amplifying* this current increase, the detector signals the leak by light, tone, and/or leak rate meter.

(3) Why not dye? In the chemical dye penetration method, the serviceman introduces a dye – usually red – into the air conditioning or refrigeration system. The dye should leak through any holes, indicating a leak. Although inexpensive and relatively sensitive, this method of leak detection requires considerably more time than electronic leak detection, and is *inflexible* and inconvenient. To use an electronic detector, the serviceman simply switches the unit on and probes the test area. He can easily probe into tight, cramped, and dirty areas, even when he cannot see the test area.

(4) With chemical dye, the serviceman must charge the system, wait for the dye to run through, then visually inspect or wipe the test area. Because hot, dirty and hard-to-reach areas are difficult to test, the applications in which this method can be used effectively are quite limited. Also, many dyes do not offer the sensitivity for detecting tiny leaks and may complicate a repair job.

(5) The other popular leak detection method, the halide torch, is much less sensitive than electronic leak detection and, though relatively quick, is subject to human error and is potentially dangerous. The halide torch burns a halide-free gas, such as acetylene or propane, through a copper-tipped burner producing a blue flame. A 3 to 5-foot hose, attached to the base of the burner, draws air into the burner by venturi action as the serviceman probes with hose. If the hose moves over a leak, refrigerant is sucked into the burner, and the burning halogen changes the flame color from blue to green. The halide torch cannot *detect* most leaks smaller than 9 ounces per year. This is almost 20 times the 0.5 ounces per year standard for a serviceman's electronic detector. Further, the serviceman must accurately detect a flame color or change -- a much less positive indication than the light, tone, or meter indication in electronic leak detection. Color blindness, bright sunlight, and inexperience can cause incorrect readings.

(6) Also, while a serviceman using electronic detection need only watch the probe, when using the halide torch he must watch both the probe and the flame. Awkward, two-handed operation and a dangerous open flame combine to limit the flexibility of halide torch leak testing. In addition, refrigerant can break down into toxic gas when burned, and the unit is *restricted* to use only in well-ventilated areas.

(7) Though chemical dye and halide torch leak detectors are available at a lower initial cost, their slower speed, inconvenience, poorer sensitivity, and dependence on operating skill render them much less practical than electronic detectors. The quickness, dependability, versatility, and ease of operation in electronic leak detection make it the most valuable method of field testing air-conditioning and refrigeration equipment available to the service engineer.

About the Article

1. What are the characteristics of a good leak detection system?
2. What systems are most widely used today? Explain briefly the fundamentals behind each system.
3. What does this author see as the best system? Why?

About Words

In the following list are words that are either synonyms or antonyms to words in the paragraph. Use your knowledge to pick out the correct word and indicate whether it is a synonym or antonym. The numbers in parentheses refer to the corresponding paragraph numbers.

effectively (1)
reducing (2)
fixed (3)
costly (3)
crowded (3)
precisely (5)
clumsy (6)
rigidness (6)
reliance (7)

Use the synonym or antonym to the above words in a sentence.

Activity

You have just read two articles by different authors expressing their views on the best kind of leak detection system. How do their opinions differ? Can you also find areas of agreement? Compare the articles.

NOW . . .SOLAR AIR CONDITIONING (33)

Vocabulary

apparatus – things necessary to carry out a purpose or for a particular use
The most important apparatus in caring for your lawn is a lawn mower.

jurisprudence – science or philosophy of law
Courses in jurisprudence are necessary in becoming a lawyer.

resign – give up a job, position
John resigned his position on the school newspaper.

With new sources of energy needed to meet the growing demands of the future, one source given a great deal of consideration is solar energy. In this article one man presents a practical approach to cooling a house by making use of a solar heating unit.

Solar household heating is widely known and practiced. Now Washington inventor Harry E. Thomason offers summer air conditioning as part of the system. He was recently granted a patent on apparatus for producing coolness at night and storing it until it is needed in the daytime warmth. The *apparatus* also stores dryness – dehumidifying the air on hot, muggy days.

Dr. Thomason, who holds degrees in physics and *jurisprudence*, has been conducting a series of courses on solar house heating and cooling at George Washington University. He is also a former Patents Office examiner. As an employee he was prohibited from getting patents, but since he *resigned* he has been granted 17 patents in the field of solar energy.

In the Washington area the inventor has built three Solaris houses, including the one he lives in. The basement of each contains a large water tank surrounded by stones. During the winter, the tank is warmed by water draining from the roof on sunny days. Both the tank and the stones store warmth, which can be circulated through the house by a blower. The stones also dehumidify.

On summer nights, an outside air conditioning compressor cools the water in the tank as well as the surrounding stones, making it possible to circulate cool air in the daytime.

Controls provide automatic cooling and dehumidification 24 hours a day. Dry air feels cooler to most people at any actual temperature.

Dr. Thomason says his Solaris houses reduce heating bills to nominal amounts, and the cooling compressor requires only half the capacity of those in conventional systems. Licenses have been granted for construction of nearly 100 Solaris heating-cooling systems in buildings around the country.

About the Article

1. What advantages does Mr. Thomason's apparatus have?
2. Mr. Thomason has built three Solaris houses. How do these homes heat during the winter? How do they cool during the summer?

About Words

Suffix Review – List the suffixes in each of the following words from the article. Also give the meanings of the words.

inventor
recently
dryness
examiner
employee
dehumidify
nearly

Use each of the above words in a sentence.

Divide the following words into syllables.

1. university
2. prohibited
3. dehumidify
4. possible
5. nominal
6. winter
7. system
8. capacity
9. including
10. practical

Activity

How important do you think the use of solar energy will be in the future? Make a list of the advantages and the problems of solar heating and cooling.

KEEP IT COOL IN COURT (34)

Vocabulary

irate – angry
The irate customer demanded to see the manager.

maintains – declares to be true
He maintains his innocence.

recess – time during which work stops
There will be a short recess before the next meeting.

relies – depends
She relies too much on other people.

(1) Recordings of courtroom temperatures will be used as evidence when the City of Denver presents its case to the legislature about the need for air conditioning city courtrooms.
(2) Chief Judge Robert T. Kingsley, who directed bailiffs to record courtroom temperatures twice daily for the next several weeks, said the temperature charts "will be used as weapons when we talk to the legislature." The judge of the Denver District Court said, "we want the legislature to know the high temperatures in which juries are required to sit. You can't get justice that way."
(3) In a continuing battle, the city maintains that air conditioning of court facilities is not its responsibility. The courts are in the City and County Building, which has only a few room air conditioners – and the Denver District, Probate, and Juvenile Courts are state-operated.
(4) The state, however, relies on a 1969 opinion which specified that county commissioners or city officials are responsible for providing facilities in which courts can operate – and for maintenance of those facilities.
(5) To cope with the heat in rooms, some lights are turned off and judges call frequent recesses. Fans are not operated in courtrooms because witnesses cannot be heard.
(6) Further, "by 3 or 4 p.m. on hot days, it's difficult to get any work from our employees," a Denver Juvenile Court official told the Denver Post. "It's even worse when we try to hold a conference on a juvenile offender in a small office. The kid is probably already irate, the parents are unhappy, and it's hot. Things sometimes don't go very well."
(8) The heat problem again became a point of contention when July heat records brought temperatures in many courtrooms – including some where trials were in session – above 90°.

About the Article

1. Who made the following statements:
   a. "By 3 or 4 p.m. on hot days it's difficult to get any work from our employees."
   b. "It's even worse when we try to hold a conference on a juvenile offender in a small office."

c. "We want the legislature to know the high temperatures in which juries are required to sit."

d. "Will be used as weapons when we talk to the legislature." (what will be used?)

2. How do high temperatures affect court proceedings?

3. Who is responsible for installing the air conditioning?

About Words

Which word in the paragraph will fit best in the sentences below? The numbers in parentheses refer to the corresponding paragraph numbers.

1. The detective gathered _____ against the suspected thief. (1)

2. The secretary was asked to _____ the minutes of the meeting. (2)

3. We were _____ to pay 10% in advance. (2)

4. The directions _____ that section "A" be attached to section "C". (4)

5. _____ delinquency is becoming a serious problem in the suburbs. (7)

What are the meanings of the above words?

Activity

Do you think that high temperatures would affect the administration of justice enough to make air conditioning necessary? Why or why not?

Vocabulary

adverse – unfavorable; harmful
Former drug users will return to their habit if nothing is done to offset the adverse influences they are exposed to when they return to their former environment.

capital – amount of money or property that a company or a person uses in carrying on a business.
The Smith Company has a capital of $30,000.

extensive – wide; broad; large
Extensive changes were made in the outdated program.

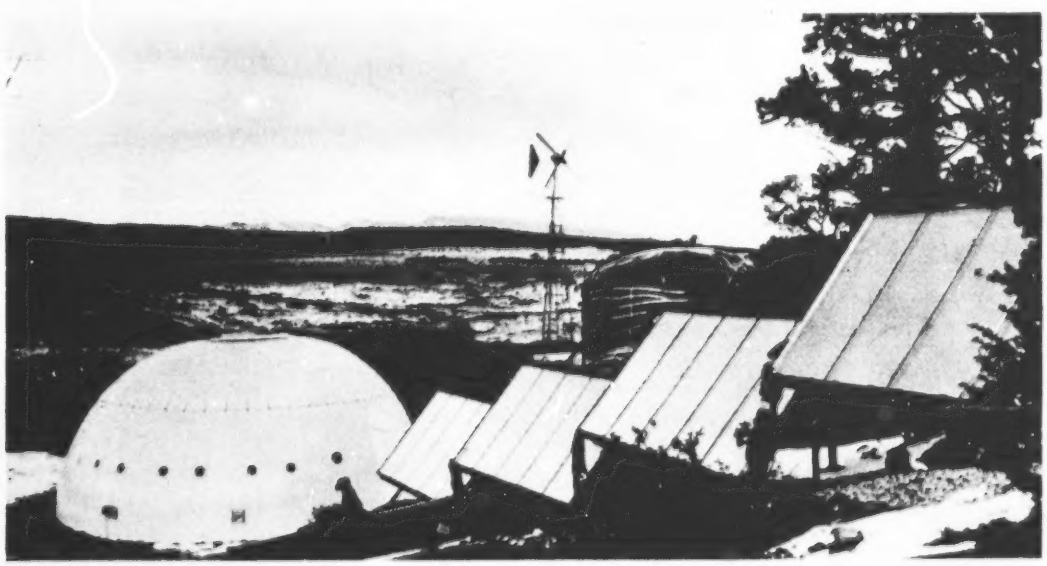
incentive – thing that urges a person on; motive; stimulus
Money is the greatest incentive to work.

implication – indirect suggestion
There is some implication of dishonesty in his failure in business.

photovoltaic – capable of producing an electromotive force under the action of light

practical – having to do with action or practice rather than thought or theory
Earning a living is a practical matter.

supplement – add to; supply what is lacking
I will supplement my income by getting a second job.



This home near Albuquerque, New Mexico, uses glass-covered solar collectors in the form of panels for low-cost heating and wind-powered generators to charge storage batteries for electrical power.

(1) The limitless potential of solar energy today captures some of the excitement generated by thermonuclear energy two decades ago. There has been much written and said about the possibilities in the use of solar energy but to this date only two seem to be *practical* with the technology of today.

(2) Solar energy can be used to *supplement* conventional methods of heating and cooling homes and commercial buildings through the use of large panels that "collect" the sun's radiation and store it by transferring the heat to water, rocks, or special salts. The technology is available, but each system and its components must be custom designed. The usual objective in the north temperate zone is that solar energy should meet half the space-conditioning requirements of a given structure.

(3) In addition to heating and cooling, solar cells can be installed. These cells will convert the sun's heat directly into electricity for household and light applicances. Excess power might be stored in conventional batteries, in flywheels, or chemically as hydrogen for use at peak periods of demand on public utilities.

(4) It is hoped that solar energy used in these ways will be able to provide 80 percent of a building's heating and electric needs at an added *capital* cost of only 10 percent. Even with the higher initial costs for development and use of a system necessary to do this, the great abundance of fuel saving would make such a system competitive.

(5) Although solar energy may be the most non-polluting of all sources, it of course has environmental *implications*.

(6) *Extensive* use of solar energy may cause one form of pollution not often mentioned: visual pollution. The incorporation of solar collectors into structures of attractive and varied design will be a severe challenge to architects. Because these solar panels must be oversized in relation to the structure, because they must all face south (in the Northern Hemisphere) and at approximately the same angle, the appearance and orientation of houses may leave much to be desired.

(7) In any case, the environmentally *adverse* aspects of solar energy are minor compared with its assets as a potentially unlimited source of clean energy that is available everywhere.

(8) Solar heating and cooling units are actually available now. However, much testing remains to be done to determine which systems and their components are most reliable and economical. How rapidly these solar energy systems are adopted thereafter will depend on many factors, involving attitudes and *incentives*. The most important motivation will be the shortage of fuel oil and electricity as it is felt by the individual consumer at the end of the decade.

(9) More ambitious schemes for converting solar radiation to electricity are fairly distant. Thus the use of the sun as an energy source will evolve slowly.

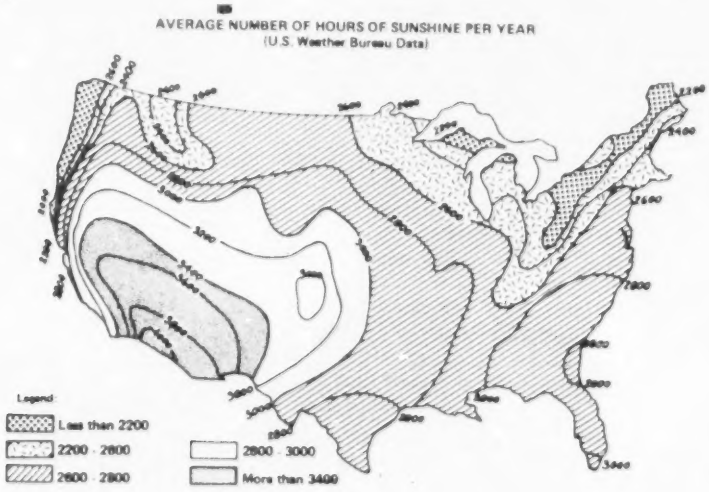
(10) In the United States, the Joint Atomic Energy Committee anticipates that solar energy will constitute about 6 percent of the supply by the year 2000. Taking a longer look, a Solar Energy Panel formed by the National Science Foundation and NASA estimated that by the year 2020 solar energy "could" provide as much as 35 percent of the nation's space heating and cooling and 20 percent of its electricity.

(11) Perhaps the brightest prospect for solar energy is in the developing world. If *photovoltaic* cells can be mass-produced at a reasonable cost, there is a possibility that the most remote area can have enough electricity.

About the Article

1. How can solar energy be used to supplement conventional methods of heating and cooling homes and commercial buildings? Explain how such a system would operate.
2. How can solar energy be converted into electrical power? How would a system of this type operate?
3. It is hoped that solar energy used in these ways will someday provide _____ percent of a building's heating, cooling, and electric needs.
4. What form of pollution may be caused by the extensive development and use of solar energy? Why?
5. What is seen as the greatest motivation to a more rapid development of solar energy?
6. How may the use of photovoltaic cells be the most practical and brightest prospect in the developing world?

Reading a Map



1. Most of the country averages _____ number of hours of sunshine per year.
2. What is the average number of hours of sunshine per year where you live?
3. What parts of the country average:
   a. more than 3400 hours
   b. less than 2800 hours
   c. 2200 – 2600 hours

4. What would the average number of hours of sunshine per day be if the average per year was:
   a. 2600
   b. 3400
   c. 2800
   d. 3000
   e. 3400

5. Based on the information provided by the map, do you think the U.S. has enough hours of sunlight per year so that a solar energy system could be practical? Why?

Before something is considered "practical" it must meet certain requirements or conditions. What conditions or requirements do you think go into making something practical? (consider things such as cost, potential for wide use, etc.)

About Words

Which word in the paragraph will best fit in the following sentences?
The numbers in parentheses refer to the corresponding paragraph numbers.

1. His_____ for 1976–1977 will be to improve his batting average by 25 points. (2)

2. Two years of a science and foreign language are some_____ needed to go to college. (2)

3. Because the team was short on infielders, the coach wanted to _____the leftfielder into a second baseman. (3)

4. Our country no longer has the_____of natural resources we once had. (4)

5. The promoter of the rock concert_____crowd of 15,000. (10)

What are the meanings of the above words?

HOW DOES AUTO AIR CONDITIONING AFFECT GAS ECONOMY? (36)

What is the difference in gas economy between an air conditioned car and a car with open windows that might create a drag, or parachute effect?

To obtain an answer, Automotive News tested a fully-equipped 1973 Ford Brougham over three nearly identical 150-mile runs between Detroit and Lansing. Gross weight of the Brougham, which had a 460-cubic inch engine, was 5,976 lbs.

One run was made with all windows closed and with the vent system used only when occupants were smoking; the second was made with both front windows open, and the third was made using air conditioning.

Weather conditions were essentially the same on all trips, and efforts were made to keep the test car's speedometer at 70 mph.

With the windows closed, the car ran 15 miles to the gallon. With the front windows open, the figure was 14.94 mpg. With air the figure was 13.33 mpg, for a loss of about 11%.

Fuel cost was $4.65 for the air conditioned run and $4.15 for the others.

Activity

This test was run in 1973. Do a test of your own to see if there has been any improvement in fuel economy under these conditions.

WHY NOT? (37)

If a plumbing contractor is a plumber, why isn't a heating contractor a heater or an air conditioning contractor an air conditioner?

DOG HAS AIR CONDITIONING – HIS MASTERS DON'T (38)

"Tigre" is an 8-month-old, 120-lb. St. Bernard. He has air conditioning even though his masters do not! "Tigre really needed it," said his owner, Mr. Jones, "because during those really hot days in August, he got what they call 'hot spots' on his stomach and they were really painful." To cure the condition, Tigre was tranquilized, lotioned, and dosed regularly with antibiotics. "The air conditioning, including the insulation we put in, will probably be cheaper than continual treatment, and a lot better for him," said Mr. Jones.

REFERENCES

(1) Harry Drake, "FBI Case #2," *Refrigeration Service and Contracting.* September 1971, pp 31–32.

(2) "Arctic Pipeline Could Be Huge Refrigeration User," *Air Conditioning Heating and Refrigeration News,* June 25, 1973, p 23.

(3) "Cars Polluting Your Air? Refrigerant May Be the Answer," *Refrigeration Service and Contracting.* September 1971, pp 34–36.

(4) "New Coal Mining Development Makes Refrigeration Essential," *Air Conditioning Heating and Refrigeration News,* November 12, 1973, p 20.

(5) "Tennis is 'In', *Refrigeration Service and Contracting.* August 1974, p 43.

(6) "Two Gals Prefer Hanging Ductwork Over Routine Secretarial Chores," *Air Conditioning Heating & Refrigeration News,* August, 13, 1973, p 16.

(7) Steve Reed "Treat Him Well – He's Becoming Rare," *Refrigeration Service and Contracting,* June 1974, p 17.

(8) "Heat Transfer Solves the Problem," *Refrigeration Service and Contracting.* August, 1974, p 40.

(9) "The Cleveland Arcade," *Refrigeration Service and Contracting.* March, 1975, p 36.

(10) Ivan Stepnich, "Serviceability Is the Key," *Refrigeration and Service Contracting.* September 1971, pp 29–30.

(11) "Refrigeration Plays Important Role in the Life of Dairy Farmers," *Air Conditioning Heating and Refrigeration,* December 3, 1973, p 38.

(12) "Air Conditioning For Year Round Recreation," *Refrigeration Service and Contracting,* October 1974, p 49 (Racquet & Rink)

(13) "Pre-Cooled Concrete for T.V.A. Project," *Refrigeration Service and Contracting,* August 1974, p 38.

(14) "Walk-in Coolers and Refrigerators Are Preferred," *Refrigeration Service and Contracting,* December 1973, p 29–30.

(15) James Goodman, "Experts Needed – Help!" *Refrigeration Service and Contracting,* February 1974, p 20.

(16) William D. Fitzgibbons, "Inflation . . .A Challenge to the Service Engineer" *Refrigeration Service and Contracting,* February 1975, pp 42–43

(17) "Freight Cars Enter Unique Test Facility Through Huge Freezer Door," *Refrigeration Service and Contracting*, February 1974, p 17.

(18) "Energy Conservation Home Can Cut Heating, Cooling Cost by Half." *Air Conditioning Heating and Refrigeration*, December 10, 1973,p 1–3–4.

(19) Ray Roberts "Does Air Conditioning in Home Affect the Quality of Life There?"*Air Conditioning Heating and Refrigeration News*, January 29, 1973,p 71.

(20) Eli Liebermann "Refrigerant Mixing – A New Service Problem," *Refrigeration Service and Contracting* October 1974, p 25.

(21) "Auto A/C Servicing Requires A Professional," *Refrigeration Service and Contracting* May, 1974,p 27.

(22) Paul Wills "Let's Hear it for Air Conditioning," *Air Conditioning Heating and Refrigeration News*, September 17, 1973, p 9.

(23) *Air Conditioning Heating and Refrigeration*, June 25, 1973, p 6.

(24) *Refrigeration Service and Contracting*, September 1974, pp 44–45.

(25) Ralph Downing "Handling Refrigerants, How Safe Are You?" *Refrigeration Service and Contracting*, May 1974, pp 28–31.

(26) Eli Liebermann "As You Use Your Tools and Instruments – Be Aware of Electrical Safety," *Refrigeration Service and Contracting*, July 1971, pp 28–29.

(27) Eli Liebermann "Safety – Learn to Recognize the Traps," *Refrigeration Service and Contracting*, December 1973, p 27.

(28) *Air Conditioning Heating and Refrigeration News*, May 14, 1973, p 2.

(29) E.F. Cahn, "How Do You Ignore A Killer?" *Refrigeration Service and Contracting*, March 1975, p 19.

(30) "America Couldn't Function Today Without the $7.1 Billion Industry," *Refrigeration Service and Contracting*, April 1975, p 19.

(31) Charles S. Booz "Updating with Dyed Refrigerant," *Refrigeration Service and Contracting*, February 1975, pp 13–14.

(32) Robert A. Dalferro "Electronic Detection Accuracy," *Refrigeration Service and Contracting*, February 1975, pp. 12–14.

(33) "Now Solar Air Conditioning," *Science Digest*, September 1974, p 87.

(34) "Courtroom Temperatures Charted in Attempt to Obtain Cooling," *Air Conditioning Heating and Refrigeration News*, July 30, 1973, p 1.

(35) *Air Conditioning Heating and Refrigeration News,* January 11, 1973, p 1.

(36) "How Does Auto A/C Affect Gas Economy?" *Air Conditioning Heating and Refrigeration News,* September 17, 1973.

(37) "Why Not," *Air Conditioning Heating and Refrigeration News,* May 14, 1973, p 47.

(38) *Air Conditioning Heating and Refrigeration News,* September, 1973, p1.